Water Management Plan for the Watersheds of the Upper Highwood* and Upper Little Bow** Rivers

Volume 1

June 2008

* Above confluence with Sheep River
*Above Travers Reservoir

Alberta
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Memorandum

From: May Mah-Paulson, M.Sc., P.Eng.
Regional Approvals Manager
Southern Region

Our File Reference:

Your File Reference:

To: Designated Directors under the Act
Southern Region

Date: June 24, 2008

Telephone: (403) 297-7883
Fax: (403) 297-6069

Subject: **Water Management Plan for the Watersheds of the Upper Highwood and Upper Little Bow Rivers – June 24, 2008**

In accordance with the Framework for Water Management Planning, the recommendations in this Water Management Plan for the watersheds of the Upper Highwood River (the Highwood River above the confluence with the Sheep River) and Upper Little Bow River (the Little Bow River above Travers Reservoir) are to be considered by decision makers under the *Water Act*.

May Mah-Paulson, M.Sc., P.Eng.
Regional Approvals Manager
Southern Region

Acknowledgements

Alberta Environment and Alberta Transportation offer thanks to the members of the Highwood Management Plan Phase 1 Public Advisory Committee for their hard work, large time commitment and dedication over several years to develop a set of recommendations concerning the Little Bow Project/Highwood River Diversion and other aspects of water management, which have broad support in the community of the Highwood and Little Bow River basins.

The contribution of Shirley Pickering in very ably chairing the Highwood Management Plan Phase 1 Public Advisory Committee is particularly appreciated.

Table of Contents

Memorandum ii

Acknowledgements iv

Table of Contents v

1. Introduction 1

2. Description of Area to which the Water Management Plan for the Watersheds of the Upper Highwood and Upper Little Bow Rivers Applies 2

3. Background 2

4. Plan Recommendations to Alberta Environment Decision Makers (the Director) 5

   4.1 Irrigation Licences with July Cutoffs 5

   4.2 Communications Between Water Users and Alberta Environment 5

   4.3 Licence for the Pre-project Little Bow Diversion 6

   4.4 Legal Status for the Highwood Diversion Plan 6

   4.5 Licensing Post-Little Bow Project Water Use 7

   4.6 Licence Allocation Transfers 7

5. Schedule for Review of the Highwood and Upper Little Bow River Water Management Plan 8

6. Future Water and Watershed Management Planning in the Highwood and Upper Little Bow River Basins 8

7. References 9

8. Glossary (including acronyms) 10

APPENDICES 11

   Appendix A – Relationship of this Water Management Plan to other Planning Initiatives 12

   Appendix B – Issues Considered 14

   Appendix C – Information Assembled 15

   Appendix D – Alberta Environment Response to the Recommendations of the Highwood Public Advisory Committee for the Highwood Diversion Plan 17

   Appendix E – Information Sheet – Information for Licence Holders and Others Interested in Water Management in the Upper Highwood and Upper Little Bow River Watersheds 32

   Appendix F – Documents in which PAC Recommendations are Addressed 34

Map 1. Area to which this Water Management Plan Applies 3

Volume 2 (Separate Volume): Highwood Diversion Plan (2008c)

1. Introduction

Alberta's *Water Act* (RSA 2000 c. W-3) provides that water management plans may be prepared for the conservation and management of water. The *Water Act* also directed that a *Framework for Water Management Planning* (Alberta Environment, no date) be prepared. Both the *Act* and the *Framework* prescribe the contents of water management plans.

This water management plan has a very specific focus: To make recommendations to Alberta Environment (AENV) decision makers concerning water quantity management[1] in the watersheds of the Upper Highwood and Upper Little Bow Rivers[2]. This water management plan does not apply to the Sheep River watershed.

This water management plan is based on the recommendations of the Highwood Management Plan Phase 1 Public Advisory Committee (PAC), and was prepared with guidance from Alberta Environment staff and the Environmental Law Section of Alberta Justice.

The recommendations have the purpose of assisting the Little Bow Project to meet its water supply objectives, while maintaining or improving the condition of the aquatic environment relative to pre-project condition. The Little Bow Project comprises diversions from the Highwood River into the Little Bow River and Mosquito Creek, the Twin Valley Dam and Reservoir, the Clear Lake Reservoir and the Women's Coulee Dam and Reservoir. The original objective of the project was to divert from the Highwood River sufficient water for the irrigation of 8,096 hectares (20,000 acres). During subsequent planning the PAC recommended that some of this water could also be made available to other uses (e.g., municipal).

A component of this plan is the Highwood Diversion Plan (AENV 2008c), which provides objectives and operating rules for diversions from the Highwood River, also for the aforementioned purpose. The Diversion Plan focuses on the administration of water under the *Water Act* and is provided in Volume 2 of this water management plan.

The degree to which this water management plan succeeds in achieving the above purpose can only be ascertained by using a continuous cycle of monitoring outcomes, and applying adaptive management to make necessary adjustments. The diversion rates and operating rules laid out in the Diversion Plan are meant to define the upper and lower limits of operation. It is the Bow Operations Manager's duty to coordinate and adjust, wherever possible, the day to day operation of Highwood Diversion systems under the Diversion Plan with the findings and recommendations of the Highwood Diversion Water Quality and Riparian Vegetation Monitoring Programs being carried out currently.

This water management plan is one step towards a comprehensive water and watershed management plan for the watersheds of the Highwood River (including the Sheep River) and the Little Bow River upstream of the Travers Reservoir. Such a plan could ultimately address all water issues, including water quality (including effects of land uses), groundwater and water quantity in all water bodies. This plan provides a platform on which additional watershed

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[1] Water quantity management refers to a focus on water allocations, water use and river flows for the aquatic environment and water quality (particularly the water quality flow dependent variables of temperature and dissolved oxygen).

[2] For the purposes of this document the Upper Highwood River is defined as above its confluence with the Sheep River. The Upper Little Bow River is defined as above Travers Reservoir.

planning can be built. This could take several years to complete, likely in a number of phases. It should be coordinated with watershed plans for the Bow and Oldman River basins.

The *Approved Water Management Plan for the South Saskatchewan River Basin* (Alberta Environment, 2006a), of which the subject watersheds are a part, provides overall guidance for water management in the South Saskatchewan River Basin. Appendix 'A' describes the relationships between other planning initiatives and the *Water Management Plan for the Watersheds of the Upper Highwood and Upper Little Bow Rivers*.

Alberta Environment staff to whom the authority has been granted to make certain decisions under the *Water Act* are referred to as the *Director*. Decisions for the Bow River watershed (which includes the Highwood River watershed) are generally made by a Director in the Calgary District office of the Southern Region of Alberta Environment. Decisions for the Oldman River basin (which includes the Little Bow River watershed) are generally made by a Director in the Lethbridge District office.

2. Description of Area to which the Water Management Plan for the Watersheds of the Upper Highwood and Upper Little Bow Rivers Applies

This plan applies only to surface water in:

- the Highwood River and its tributaries above its confluence with the Sheep River,
- the Little Bow River and its tributaries above Travers Reservoir,
- Mosquito Creek and its tributaries,
- Twin Valley Reservoir,
- Women's Coulee Reservoir, and
- Clear Lake.

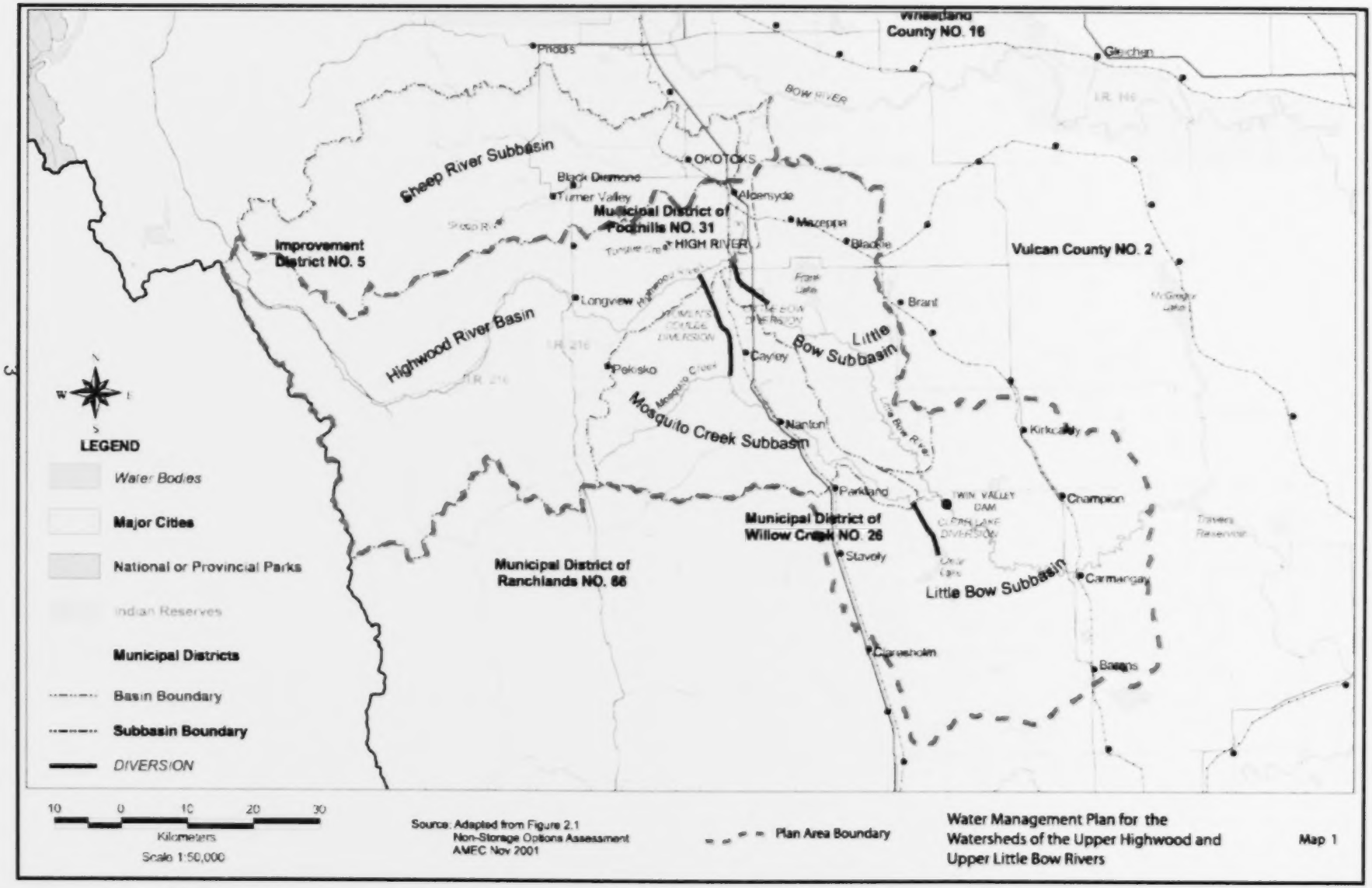
This plan applies to all of the named rivers, their tributaries and all natural surface water with hydrological connection to the named rivers and tributaries. Groundwater that readily flows under the ground and is connected to or influenced by surface water bodies is also considered surface water.

See Map 1.

3. Background

Following public hearings concerning the Little Bow Project in 1997 and 1998, a Joint Panel of Alberta's Natural Resources Conservation Board (NRCB) and the federal Canadian Environmental Assessment Agency approved the project overall, but reserved judgment on one aspect, that being diversions from the Highwood River during the low-flow periods in July and August. This led to the formation of a multi-stakeholder community group to develop recommendations concerning these diversions. This group was the Highwood Management Plan Phase 1 Public Advisory Committee (PAC).

Between 2001 and 2006 the PAC conducted extensive analyses and negotiations and succeeded in creating a set of recommendations with broad community support. The recommendations were tested with the general public in five open houses. In 2006 the PAC submitted its recommendations (Highwood Public Advisory Committee, 2006) to AENV. Due to


Wheatland County NO. 16
Strathmore
Gleichen
BOW RIVER
OKOTOKS
Black Diamond
Turner Valley
Aldersyde
Municipal District of Foothills NO. 31
Mazeppa
Blackie
HIGH RIVER
Improvement District NO. 5
Vulcan County NO. 2
Longview
Brant
Highwood River Basin
Little Bow Subbasin
Carseland
Pekisko
Nanton
Mosquito Creek Subbasin
Kirkcaldy
Parkland
TWIN VALLEY DAM
Champion
Municipal District of Willow Creek NO. 26
Municipal District of Ranchlands NO. 66
Stavely
Carmangay
Little Bow Subbasin
Claresholm
Barons
LEGEND
Water Bodies
Major Cities
National or Provincial Parks
Indian Reserves
Municipal Districts
Basin Boundary
Subbasin Boundary
DIVERSION
10 0 10 20 30
Kilometers
Scale 1:50,000
Source: Adapted from Figure 2.1 Non-Storage Options Assessment AMEC Nov 2001
Plan Area Boundary
Water Management Plan for the Watersheds of the Upper Highwood and Upper Little Bow Rivers
Map 1

the exhaustive work of the PAC and the consensus it achieved in the community, no additional consultations were conducted by AENV during the preparation of this plan.

A list of the general issues addressed by the PAC and the means by which the recommendations are addressed by AENV is provided in Appendix 'B'. A list of the information assembled during the process is provided in Appendix 'C'.

During the course of developing a revised diversion plan, it became evident that not all objectives for the revised plan could be met. The task became one of compromise and balance. Based on the principal and central recommendation, that being a scenario for water diversion that achieved the best possible balance between diversions for water supply and protection of the Highwood River fishery, AENV prepared a revised *Highwood Diversion Plan* (AENV 2008c). The revised diversion plan was designed to achieve:

- flows in the Highwood River downstream of diversions for protection of aquatic ecosystems at least as much as pre-project conditions
- flows in the Little Bow River and Mosquito Creek to provide good water quality and support the development of a healthy riparian environment
- diversions to support the irrigation and other water uses for which the Little Bow Project was constructed
- no net harm to pre-project water users or environmental values along the Highwood River, Little Bow River and Mosquito Creek

In its deliberations the PAC concluded that, in order for the above balance to be achieved, recommendations were also required concerning broader matters of water management. It is these recommendations that provide the basis for this plan. These, and the recommendations concerning monitoring, are what the PAC referred to in its recommendations report as: *Contingent measures or strategies for implementing and operating the Highwood Diversion Plan are essential and inseparable from the diversion plan itself* (p. 62, Highwood PAC 2008c).

A central question throughout the process was whether additional water storage (primarily expansion of the existing Women's Coulee Reservoir) would be necessary to provide reliability of supply for water users and to mitigate impacts on the aquatic environment (including water quality). Several alternative storage sites were investigated. The most favorable site, expansion of Women's Coulee Reservoir, was studied in further detail. A key recommendation of the PAC was that expansion of the Women's Coulee Reservoir could not be justified in terms of the financial cost and environmental impacts relative to the small environmental benefit to the Highwood River. The Highwood Diversion Plan (HDP) and the recommendations contained in this plan were designed to provide the best balance in achieving the Little Bow Project objectives without the construction of additional water storage.

The PAC's recommendations are included in Appendix 'D' along with the responses of AENV. AENV indicated acceptance of most of the recommendations, although with qualifications.

The PAC emphasized the need to monitor the performance of the HDP. This would support adaptive management for fine tuning of the HDP as required.

In addition to this document, the recommendations of the PAC have led to the creation by AENV of the following documents:

1. The revised *Highwood Diversion Plan* (AENV 2008c)
2. A draft monitoring plan for the performance of the HDP

3. An information sheet for holders of licenced water allocations and others with an interest in water management in the subject area. This information sheet is appended to this document (Appendix 'E')

Appendix 'F' shows in which documents the PAC's recommendations are addressed.

AENV and Alberta Infrastructure and Transportation (now Alberta Transportation) jointly applied to the NRCB in December 2006 for final approval of the Little Bow Project. The application comprised:

- The revised *Highwood Diversion Plan* (AENV 2008c)
- The Recommendations Report of the PAC (Highwood PAC 2006)
- AENV's responses to the recommendations (AENV 2006b)

4. Plan Recommendations to AENV Decision Makers (the Director)

4.1 Irrigation Licences with July Cutoffs

(with reference to PAC recommendation 1.1)

Due to past water supply limitations, many irrigation licences in the Upper Little Bow River basin have a condition that irrigation must stop on specified dates on or about the end of July. As a result of the Little Bow Project and the revised HDP, water availability for irrigation will be improved so it may no longer be necessary for irrigation to always cease at the end of July, even while maintaining minimum operating target flows for the Little Bow River and Mosquito Creek.

Recommendations to the Director

- The Director could consider applications from licence holders for amendments to permanently remove the July cutoff condition from licences that contain the condition.
- When amending existing licences that have a July cutoff condition, the Director could consider adding as conditions on licences the minimum operating flow targets[3] for the Little Bow River and Mosquito Creek and that these could be eventually replaced by water conservation objectives.
- The Director could consider establishing Water Conservation Objectives (WCO). In this regard the Director could consider the instream objective for the Highwood River[3] and minimum operating flow targets for the Little Bow River and Mosquito Creek[3], as well as WCOs that have been established downstream, including in the Bow or Oldman Rivers.

4.2 Communications Between Water Users and AENV

(With reference to PAC recommendation 1.3)

Water for irrigation can be used more efficiently if the operators of the Highwood water diversions and Twin Valley Dam can time water deliveries to match when irrigators can use the water.

[3] As stated in the HDP

Recommendation to the Director

- AENV could consider working with water users to develop a communications system that will work for all concerned to assist in coordinating water deliveries.

4.3 Licence for the Pre-project Little Bow Diversion

(With reference to PAC recommendation 3.0)

Diversion from the Highwood River into the Little Bow River basin first took place early in the early 1900s. A licence under the *Water Act* (or its antecedents, the *Water Resources Act* and *Northwest Irrigation Act*) for the original diversion by the Government of Alberta from the Highwood River into the Little Bow River was never issued because licences were not required by government projects at that time.

Recommendation to the Director

- It is recommended that a licence for the pre-project 2.83 m^3/s (100 cfs) Little Bow Diversion be issued to the Crown in Right of Alberta as represented by AENV.

4.4 Legal Status for the Highwood Diversion Plan

(With reference to Highwood PAC recommendation 4.0)

A licence under the *Water Act* authorizing the operation of a water diversion can include, as one of its conditions, a detailed plan for the operation of the diversion.

Recommendation to AENV Water Management Operations

- AENV Water Management Operations consider making application for an amendment to the licences for the Women's Coulee and Little Bow Diversion works to incorporate the revised HDP as a licence condition.

Recommendations to the Director

- The Director could consider such an application.
- If the application is approved, future modifications to the HDP that significantly affect performance in meeting objectives should be subject to public review and the appeal process under the *Water Act*.
  - Procedures for modifying the operation plan could be included as conditions on the amended licences. These procedures could recognize that the HDP is based on the principle of adaptive management and is intended to be modified according to the findings and recommendations of the water quality and vegetation monitoring programs.
  - These procedures could be defined in consultations with the PAC or watershed stewardship group that may be formed, and the licensee, AENV Water Management Operations.
  - Under the *Water Act* public notice will be required, and Statements of Concern could be submitted by directly affected members of the public.

4.5 Licensing Post-Little Bow Project Water Use

(With reference to PAC recommendation 5.0)

One purpose of the Little Bow Project was to make additional water available for allocation. The initial planning was based on expanded irrigation water use; however, over the course of planning it was recognized that there may be other legitimate water demands in the area and there was support for consideration of applications for water for any purpose.

The project makes available for allocation enough water from or downstream of the Twin Valley Reservoir for the irrigation of 6,677 hectares (16,500 acres) and 1,417 hectares (3,500 acres) from the Clear Lake portion. This has been determined by AENV to be 30,167 cubic decameters (24,435 acre feet).

The Crown Reservation for the Bow, Oldman and South Saskatchewan Rivers permits allocations to be made for the Little Bow Project. The Crown Reservation supersedes any existing moratoria on issuance of licences.

Recommendations to the Director

- The Director consider applications for licensed allocations from the Twin Valley Reservoir and the Little Bow River down to Travers Reservoir for all purposes up to the volume limit of 30,167 cubic decameters.
- The licences should be subject to the instream objective for the Highwood River[3] or the minimum operating flow targets for the Little Bow River[3] and Mosquito Creek[3], or water conservation objectives that may be established in the future for these water bodies.

4.6 Licence Allocation Transfers

(With reference to PAC recommendation 7.0)

The Approved Water Management Plan for the SSRB (the SSRB Plan) authorized AENV *Water Act* Directors to consider applications for the transfer of licensed water allocations. As stated in the SSRB Plan, the rationale for authorizing the use of transfers in the SSRB are:

In highly-allocated basins, water allocation transfers are a means by which a reliable (high priority) water allocation could be obtained, providing a party willing to transfer all or part of their allocation could be found. This would enable a new enterprise to locate in these basins, to the benefit of the economy. The ability to transfer part of an allocation for financial benefit provides an incentive for existing licence holders to increase water use efficiency (p. 12, AENV 2006a).

The SSRB Plan also authorized the Director to withhold up to 10% of the volume of transferred allocations to protect the aquatic environment or to implement a water conservation objective if the Director is of the opinion this is in the public interest.

The SSRB Plan (Table 1) lists matters and factors that must be considered in making a decision on an application for transfer of a water allocation.

[3] As stated in the HDP

The HDP is a finely-tuned balance between diversions and the health of the aquatic environment and water quality. Transfers can be used in ways to benefit the aquatic environment; for example, by moving points of diversion downstream so flows remain in the stream over a greater distance.

Recommendation to the Director

- In addition to the required consideration of the matters and factors stated in the SSRB Plan, licence allocation transfers in the planning area that could potentially or cumulatively have the following effects should be favorably considered:
  - Beneficial, or at the very worst benign, to the health of the aquatic environment and water quality in the Little Bow and Highwood Rivers and Mosquito Creek.
  - No increase in the demand for diversion from the Highwood River, or changes in season of use, that could have outcomes worse than pre-project conditions for the aquatic environment or water quality.
  - Improved flows in the Little Bow River to support the development of a healthy riparian environment, sustain a northern pike fishery and support multi-purpose uses of the Twin Valley Reservoir.

5. Schedule for Review of the Highwood and Upper Little Bow River Water Management Plan

An official schedule for review of this plan is not suggested at this time. It is recommended that it be reviewed and amended as required. When future phases are to be added to the plan it could be reviewed and amended at that time.

6. Future Water and Watershed Management Planning in the Highwood and Upper Little Bow River Basins

Under the *Water For Life* (AENV 2003) policy, Alberta Environment is encouraging a more holistic approach in which the water resource is managed at the scale of the watershed, for both quantity and quality. Water quality and quantity can be affected by land management practices in a watershed. Watershed management will require the participation of the parties that manage land, including landholders, municipalities, etc.

Future watershed management in the Highwood and upper Little Bow River basins should include all parties with an interest in, or the ability to affect, water quality and quantity. This will include the headwaters, tributaries and most importantly, the Sheep River watershed. Partnership and cooperation with the Bow River Basin Council and the Oldman Watershed Council is also recommended.

7. References

Alberta Environment, no date. *Framework for Water Management Planning.* Edmonton, Alberta.

Alberta Environment, 2006a. *Approved Water Management Plan for the South Saskatchewan River Basin.* Edmonton, Alberta

Alberta Environment, 2006b. *Alberta Environment Response to the Recommendations of the Highwood Public Advisory Committee for the Highwood Diversion Plan.* Calgary, Alberta

Alberta Environment, 2006c. *Highwood Diversion Plan.* Calgary, Alberta

Alberta Environment, 2003. *Water For Life, Alberta's Strategy for Sustainability.* Edmonton, Alberta

Bow River Basin Council, 2005. *The 2005 Report on the State of the Bow River Basin.* Calgary, Alberta.

Highwood Management Plan Phase 1 Public Advisory Committee, 2006. *Vol. 1, Report and Recommendations for Highwood Diversion Plan, Highwood Water Management Plan, Phase 1.*

Water Act (RSA 2000 c. W-3)

8. Glossary (including acronyms)

AENV – Alberta Environment

Adaptive management - A systematic process for continually improving management policies and practices by learning from the outcomes of previously employed policies and practices (Source: Green Facts Glossary).

Cubic decameter – A measure of volume that is a cube 10 meters on a side. Equals 0.81 acre feet.

Director – From the *Water Act*:

Section 1(1)(k): *"Director" means an individual designated as a Director for the purposes of all or part of this Act by the Minister under Part 13"*

The individual must be an employee of the Alberta Government.

Instream objective – Flows that are to be maintained in a stream as a result of dam operation or by restrictions on licences to provide some level of protection of the aquatic environment.

Minimum operating flow target – The absolute minimum flow required to maintain (unless natural flow is less) riparian needs and fulfill the needs of water users.

PAC – Highwood Management Plan Phase 1 Public Advisory Committee.

Water conservation objective - From the *Water Act* (Section 1(1)(hhh):

"Water Conservation Objective" means the amount and quality of water established by the Director under Part 2, based on information available to the Director, to be necessary for the

(i) protection of a natural water body or its aquatic environment, or any part of it;
(ii) protection of tourism, recreational, transportation or waste assimilation uses of water; or
(iii) management of fish or wildlife, and may include water necessary for the rate of flow of water or water level requirements.

A licence may be issued by the Director to the Government of Alberta for the purpose of implementing a Water Conservation Objective.

Watershed - An area of land that catches precipitation and drains into a body of water, such as a marsh, stream, river or lake.

APPENDICES

Appendix A

Relationship of this Water Management Plan to other Planning Initiatives

Approved Water Management Plan for the South Saskatchewan River Basin (SSRB)

In August 2006 the Approved Water Management Plan for the SSRB (the "SSRB Plan") came into force with the approval of the Lieutenant Governor-In-Council. All water management plans in the SSRB must be consistent with this plan. The principal concepts of the plan relevant to the Highwood and Little Bow River basins are:

- The limit of the water resource has been reached in the Bow, Oldman and South Saskatchewan River sub-basins.
- Opportunities to restore flows to these rivers should be taken.

The SSRB Plan recommended:

- A Crown Reservation for the Bow and Oldman River basins. This requires Alberta Environment (AENV) accept applications for unallocated water only for certain purposes that are specified in the Crown Reservation. The Crown Reservation came into effect on 03 August 2007.
- Water Conservation Objectives that will generally have the effect of promoting flow restoration for the Bow, Oldman and South Saskatchewan Rivers. These Water Conservation Objectives are to be considered by AENV decision makers when deciding on Water Conservation Objectives in tributaries such as the Highwood River. The Water Conservation Objectives were established on 16 January 2007.
- Matters and Factors that must be considered by AENV decision makers when deciding whether to issue certain authorizations such as water allocation transfers.
- Several broader strategies for improving protection of the aquatic environment and the efficiency and effectiveness of water use.

Watershed Management Planning

Under the *Water For Life* strategy watershed planning and advisory councils were established for the Bow and Oldman River sub-basins, known as the Bow River Basin Council (BRBC) and the Oldman Watershed Council (OWC), respectively. This plan applies to parts of the watersheds of both the Bow and Oldman Rivers.

The BRBC has completed a State of the Bow River Basin report (BRBC 2005) and is preparing the first phase of a watershed management plan, focusing on water quality matters. The OWC is commencing a state of the basin report which will inform future watershed planning.

Cumulative Effects Management

The Government of Alberta is developing a new outcomes based environmental management system that is capable of managing cumulative effects. The new management system is being implemented using several approaches including:

- Ensuring everyone understands and knows what the system means for them,
- Building the knowledge and information systems to support the system, and
- Building the supporting governance structure, including an enabling regulatory framework.

Municipal Planning

This plan has no legal relationship to statutory planning conducted by municipalities under the *Municipal Government Act*.

Appendix B

Issues Considered

During the preparation of its recommendations the PAC considered the issues listed below. The means by which each issue was addressed by AENV is described.

Issues Considered	Means by which Addressed
The ability of the Little Bow Project to meet its objectives: • Reliable water supply that is sufficient for irrigation of 8,096 hectares (20,000 acres). • Increase water supply reliability for existing water users (and making it possible to avoid having to stop irrigating at the end of July).	Accounted for in recommended diversion plan scenario.
The negative impacts that water diversions from the Highwood River have on the aquatic environment, particularly fish.	Accounted for in recommended diversion plan scenario. Highwood PAC used criterion that no pre-project water users (consumptive and non-consumptive) would be negatively impacted.
The need to monitor the performance of the Little Bow Project over time in order to make adjustments to optimize performance.	A separate monitoring plan.
The positive and negative impacts that the Little Bow Project could have on other parts of the aquatic environment such as wetlands and riparian vegetation.	Flows to promote and sustain wetlands and riparian vegetation are part of the Little Bow Project and the HDP.
The costs and benefits (economic and environmental) of construction of additional water storage.	Studies of storage and non-storage options were carried out.
The ability of the Little Bow Project to achieve its objectives without the construction of additional water storage.	Accounted for in recommended diversion plan scenario.
The impacts of the Little Bow Project on pre-project water users.	Accounted for recommended diversion plan scenario.
Water utilization by existing licence holders (including non-use and overuse).	A water use audit was carried out and the PAC recommended that AENV cancel inactive licences and not re-allocate the water. The former is a standard part of the responsibilities of AENV and the latter a function of the Crown Reservation for the Bow, Oldman and South Saskatchewan River Basins.
Special water management required during water shortages.	Included in the revised Highwood Diversion Plan.
The existing and potential water supply needs for water users other than irrigation, such as municipalities, industries and other agriculture (e.g., feedlots).	Original intent was to make reliable water supplies available for irrigation only. PAC recommended consideration of applications for other purposes and this is reflected in this plan.
Water quality in reservoirs and its potential to affect recreation and fish.	Part of monitoring plan.
The ability to manage and administer water as efficiently as possible in order to minimize waste and to enable the Little Bow Project to meet its objectives.	Part of this plan and also a strategy contained in the Approved SSRB Water Management Plan.
The longstanding absence of licences for the government diversions from the Highwood River into the Little Bow system.	A recommendation of this plan.

Appendix C

Information Assembled

This plan was prepared based on two primary sources of information:

- The recommendations of the PAC (final report, June 2006).
- The response of AENV to the recommendations (as submitted to the NRCB in December 2006).

During the preparation of its recommendations the PAC assembled and evaluated an extensive body of information as listed below. The reference section of this plan lists the specific reports and other documents.

Biological Information

- The river flows required to maintain a healthy aquatic environment, particularly for fish, in the Highwood River between the diversion to the Women's Coulee Reservoir and the confluence with the Sheep River.
- The potential positive and negative impacts on the Little Bow River that could result from increased flows. In particular, management methods to promote riparian vegetation along the Little Bow River were examined.
- Fish habitat modeling
- Water quality modeling which predicts water temperatures and dissolved oxygen with different river flows. This was used to predict potential effects on fish.
- Riparian vegetation modeling

Regulatory

- 1998 Decision Report of the Joint Panel Review (Alberta's Natural Resources Conservation Board and Canadian Environmental Assessment Agency)
- 1997-1998 Environmental Impact Assessment Hearings of the Joint Review Panel
- 1994 Highwood River Diversion Guidelines
- Interim Highwood River Diversion Plan
- Historical and existing water licensing
- Water Act and regulations
- Comments of Fisheries and Oceans Canada
- Water licence moratoria established in the Highwood and Little Bow River basins.
- Phase One Approved Water Management Plan for the South Saskatchewan River Basin.
- Draft (Phase Two) Approved Water Management Plan for the South Saskatchewan River Basin.

Economics

- Water needs for communities
- A data base of water supply and consumption

Water Management

- Historical water supply data
- Existing water licences
- Current water demand for irrigation, livestock, other agriculture, municipalities, rural domestic, industry and recreation
- Re-constructed natural flows for the Highwood River
- An evaluation of non-storage options that would permit water to be managed as effectively as possible, thereby permitting it to be available to help meet the objectives of the Little Bow Project, and to sustain at least pre-project conditions for the aquatic environment and water users.
- Water conservation measures

Engineering

- A study of water storage options, and their potential performance and impacts.
- Pipeline options to augment water supplies in the Highwood/Little Bow River with water from the Bow River.
- Computer simulations of water supply and demand scenarios for the Highwood/Little Bow system done by AENV using its Water Resources Management Model. This incorporates use of the Irrigation Requirements Model developed by the Irrigation Branch of Alberta Agriculture and Food. Sixty scenarios were prepared, run and evaluated in detail.

Public Input

- Community-defined priorities for water management as expressed by the public verbally and in questionnaires, particularly during the open houses held in Vulcan and High River in Fall 2005.

Appendix D

Alberta Environment Response to the Recommendations of the Highwood Public Advisory Committee For the Highwood Diversion Plan

04 December 2006

General Responses:

- Alberta Environment (AENV) accepts almost all of the recommendations of the Highwood Public Advisory Committee (PAC). The Department extends its thanks to the PAC members for their hard work, time and dedication over the years required to develop the recommendations.

- In responding to the recommendations it must be recognized that Alberta's *Water Act* gives the authority for decision-making concerning matters such as water allocation transfers to Directors, who are certain designated employees of AENV. Directors must make decisions on an unfettered basis, using information available to them. In other words, direct instructions cannot be given, but recommendations can be made.

- AENV will, in consultation with the PAC, put the recommendations as accepted or qualified by AENV, into the form of a water management plan. This plan will be the key reference for the Directors in decision-making, and will also serve as a platform for future watershed planning.

- Under the *Water For Life* policy, Alberta Environment is encouraging a more holistic approach in which the water resource is managed at the scale of the watershed, for both quantity and quality. Watershed management planning should include all the people, agencies and organizations that make land management decisions, to ensure that water quality and quantity outcomes are shared and implemented.

- AENV is also embarking on a new approach to its responsibilities and objectives, known as: Sustainable Resource and Environmental Management (SREM). This approach has been adopted because of the recognition that no single government department or any other body can manage the many complexities of the environment and resources by itself. The SREM approach means AENV will work with other government departments, external organizations and stakeholders who will take joint responsibility to achieve agreed-upon natural resource and environmental management outcomes. Among the SREM principles, the following are particularly relevant at this stage of the Highwood / Little Bow project:
  - Resource and environmental stewardship
  - Sharing responsibility
  - Developing flexible regulatory and non-regulatory tools
  - Continuous improvement

  The SREM approach is reflected in some of the responses that follow.

- It is anticipated that future water and watershed planning in the basin will include engagement of First Nations concerning their interests.

PAC Recommendations and AENV Responses:

The PAC makes the following recommendations for the development and operations of a new Highwood Diversion Plan based on the assessment of over 60 scenarios.

1.0 Highwood Diversion Plan Without Storage

It is recommended the Highwood Diversion Plan be developed based on the attributes of Scenario IDP8CS1, which does not include additional storage in Highwood basin. Details of the storage assessment are found in the Fact Sheet: Review of Additional Storage (Middleton 2004; Compendium). The key attributes, priorities and performance of Scenario IDP8CS1 are outlined in Chapter 5.0 of this report. An Alberta Environment operations report (draft) on the proposed Highwood Diversion Plan (HDP), based on Scenario IDP8CS1, is available as a separate document.

AENV Response:

- The recommendation is accepted.
- The Highwood Diversion Plan (November 2006) submitted to the NRCB is based on the WRMM scenario IDP8CS1 that was developed in collaboration with the PAC.
- AENV recognizes that the diversion plan is a compromise between optimal performance for water users and optimal flows for the aquatic environment.
- AENV also recognizes that the diversion plan is based on computer simulations and not directly on real world experience. Therefore, the performance of the plan should be monitored by AENV and partners for the purpose of refining it on an on-going basis to best meet objectives.
- AENV will continue to monitor water temperature and dissolved oxygen in the lower Highwood River and will, if necessary, stop or slow AENV water diversions to protect the fishery. Water users will be kept informed of the status of water conditions and of the likelihood of water diversions being limited.

Contingent measures or strategies for implementing and operating the Highwood Diversion Plan are essential and inseparable from the diversion plan itself. These are as follows.

1.1 Irrigation Licences with July Cutoffs

It is recommended pre-Little Bow Project irrigation licensees holding licences with July cut-offs be given a two-year opportunity to apply for removal of the cut-off by licence amendment.

Sub-recommendations:

- Licensees be given the opportunity to permanently remove the cut-off date, subject to instream conditions.
- Those licensees who choose not to apply for removal of the cut-off not have their cut-offs extended in future years…
- …notice of this window of opportunity be forwarded to the licensees, along with application forms for amendments. …a reminder be sent out to those licensees who had not submitted an application within one year of the first notice.

AENV Response:

- AENV generally supports the recommendation to encourage licensees to amend their licences to remove the cutoff dates, but does not support restricting the time to apply for such amendments. If a licensee chooses to not amend his/her licence, it becomes the Directors' decision in future to extend the date of cutoff (or not) or to issue a temporary diversion licence (TDL). The decision will depend on whether there is enough water supply and if other TDLs are being granted on the system. However it is not likely that licenses would be granted more than one extension of the July cutoff since that would be sufficient time to apply for an amendment.
- Licences that have the July cut-off removed would be subject to the minimum operating flows at the point of diversion of licences as modelled in the recommended scenario IDP8CS1.
- AENV does not accept the recommendation concerning notice of the opportunity to amend licences due to priorities and the staff time required.
- If, through practical experience and monitoring, the minimum operating flow targets are verified as, or revised to be, optimal, they might be considered by the Directors for establishment as WCOs. Conditions could be added to licences that the minimum operating flows will be replaced by water conservation objectives.

1.2 Performance Monitoring for Adaptive Management

It is recommended that a monitoring program and performance assessment strategy be developed and implemented to evaluate the effectiveness of the Highwood Diversion Plan in achieving the water management objectives and to provide a basis for adaptive management of the system.

Commitments to completing the monitoring programs and providing timely interpretations must be adhered to and carried out in consultation with a core group of the Phase 1 HWMPPAC to assure timely, responsible and accountable adaptive management decisions. The monitoring agency should report to the core group on a regular basis, at least annually, on the status of the monitoring program and future plans.

AENV Response:

- The recommendation is accepted.
- AENV recognizes the importance of monitoring the performance of the diversion plan and the need to make adjustments if necessary to meet the objectives of the project.
- AENV will be one participant in designing and implementing monitoring programs. It is anticipated that WPACs and Watershed Stewardship Groups (WSGs) will be key participants in monitoring programs in the future. This could include design, implementation, data analysis and interpretation, and dissemination of results.
- AENV agrees with the following suggestions made by the PAC core group in the meeting with AENV staff on Sept. 5, 2006:
  - An inventory should be prepared of all the monitoring presently underway in the Highwood/Little Bow basins. This should include information such as:
    - Who is conducting the monitoring?

    - Why is it being conducted?
    - Where is it being conducted?
    - How long has it been underway?
    - How much longer is it to continue?
    - What is the source of funding?
    - How long will the funding continue?
    - How are the data being recorded, used and reported?
  - Baseline conditions should be established for all monitored parameters to permit future comparisons. (It is noted that baselines are a function of the number of data points and may evolve as the number increases over time.)
  - A detailed monitoring plan be prepared.
- AENV is prepared to work in partnership with the recommended Highwood Watershed Stewardship Group (see response to Recommendation 1.5) to accomplish the above.
- AENV's lead agent for the monitoring program will be Mr. Brian Mallett, Bow Operations Manager, Water Management Operations. Mr. Mallett will organize a meeting to update the PAC on the monitoring plan, including the information requested above.
- If indicated as necessary through the monitoring program, adjustments to operations to balance environmental outcomes and diversion performance will be made within the framework of the diversion plan. Adjustments outside the scope of the diversion plan will require public consultation.
- Alberta Infrastructure and Transportation has recommended an aquatic monitoring program. This program is underway and includes: development of fisheries in Twin Valley reservoir, mercury levels in fish, and changes to fish populations in the Little Bow River. Additional monitoring of water quality, riparian response to increased flows in upper Little Bow River, avian response to riparian vegetation change, and waterfowl use of Clear Lake mitigation ponds is currently underway. Additional monitoring of the project and its environmental impact may be recommended by Alberta Infrastructure and Transportation when a final monitoring program for the terrestrial components of the project is provided to Alberta Environment.

1.2a Water Quality Monitoring

It is recommended that AENV review existing water quality monitoring in the Highwood and Little Bow River Basins by all parties (Provincial and Federal Governments, industry, communities, rural municipalities, Ducks Unlimited, Trout Unlimited, etc), and develop a comprehensive, co-coordinated plan to provide a database for addressing a number of issues, including:

- **Frank Lake water quality impacts on the Little Bow River and Twin Valley Reservoir.**
- **Upper Little Bow water quality for maintenance of the aquatic ecosystem and protection of municipal, domestic, stock water, and irrigation water supplies.**
- **Mosquito Creek water quality for the protection of municipal, domestic, stock water, and irrigation water supplies. The new flow regime has significantly increased turbidity in Mosquito Creek.**
- **Determining the water quality suitability of the Twin Valley and Clear Lake Reservoirs for their respective multi-purpose uses (e.g. recreation, irrigation, source for raw drinking water, fishery).**

- **Highwood River water quality for maintenance of the aquatic ecosystem and protection of municipal, domestic, stock water, industrial and irrigation water supplies.**

AENV response:

- Much of the recommended monitoring is underway. AENV will continue to conduct this monitoring and will encourage and explore other approaches for carrying out this monitoring, such as working with other partners or local volunteers.
- Both existing and future data from monitoring will be analyzed by AENV to assist in future management of the basin.
- Government staff have recommended the monitoring also include:
  - Downstream impacts on oxygen, ammonia, metals, and aquatic plants in the Little Bow
  - Fish mercury residues in Twin Valley Reservoir and downstream Little Bow.
  - Sediment loads in Mosquito Creek to help determine if additional channel stabilization is warranted for Women's Coulee diversion channel.

1.2b Highwood River Fishery Water Temperature and Dissolved Oxygen Operating Criteria

It is recommended that AENV undertake monitoring and analyses to determine the appropriateness and effectiveness of the temperature and oxygen criteria in the 1994 Highwood River Diversion Guidelines and associated operating and monitoring procedures. It is recommended that an assessment be carried out to determine whether or not changes in the diversions triggered by the temperature and dissolved oxygen criteria have had the desired impact on Highwood River water quality.

AENV response:

- AENV agrees that monitoring should be conducted to determine if desired outcomes for the aquatic environment are achieved (i.e., the Highwood River fishery and aquatic ecosystems sustained or improved over conditions that existed prior to the project).
- Nationally adopted water temperature and dissolved oxygen criteria will continue to be used unless there is clear evidence that different criteria should be used to achieve the desired outcomes for the aquatic ecosystem. The effects of the change in Highwood operations on these parameters in the Highwood River, as well as the effects on the Little Bow and Women's Coulee/Mosquito Creek aquatic environments, will be monitored, documented and analyzed to help determine if management can be improved in the future.
- Highwood DO & water temperature have been on the Department's website for some time. This gives the users access to the information to help them make decisions on measures that could be taken to aid the resource. The website for the data is: http://www3.gov.ab.ca/env/water/ws/data/stnreport/tables/BOW-WHIWALD-ST.txt

1.2c Riparian Habitat

It is recommended efforts be made to operate the Little Bow Diversion works in a manner that fosters a healthy riparian environment along the Upper Little Bow River (Rood et al, 2002 and 2002A). It is recommended that AENV develop and implement a monitoring and management program that tracks geomorphologic and riparian vegetation changes along the Upper Little Bow River

AENV response:

- As part of the environmental mitigation monitoring program for the Twin Valley Reservoir project, AENV has initiated monitoring of vegetation and geomorphologic changes along the Little Bow River as the channel changes to accommodate the increased flows.
- AENV has incorporated the recommended flow step down guidelines for cottonwood establishment into the diversion plan. The guidelines will be implemented when conditions are favorable.
- The Department, in collaboration with partners, is currently exploring methods for conducting riparian monitoring. A pilot riparian monitoring project (aerial videography) will likely be conducted by the Department this fall.
- It should be understood that AENV does not manage land (except for rights-of-way) so a management program for riparian habitat would have to be carried out by private landowners to achieve healthy riparian environments.

1.2d Water Use Monitoring and Reporting

It is recommended that AENV develop and implement a simple water use monitoring and reporting system to record the annual and seasonal variations in water uses and return flows in the Highwood and Little Bow River Basins. Improved monitoring and reporting is required to assist in planning, operations and enforcements.

Sub-recommendations:

- Water use return cards and clear instructions should be developed by AENV for the convenience of the user. On-line reporting is an option that should be considered.

AENV response:

- The recommendation is accepted. Implementation is already underway:
  - AENV has set up a Water Use Reporting website. It is in its first year of use for licensees to voluntarily sign on to the website and electronically report their water use under licence. In the future, electronic reporting will be required or expected of all licensees. Future iterations of the WUR tool may include return flows. The website is: http://www3.gov.ab.ca/env/water/wur/submission.html
  - Existing licensees can also submit their water use returns in paper format.
  - All new licences issued require measurement and recording of water diversion. This also applies to new licences that are issued as a result of transfers.
  - The information on the Water Use Reporting website is public information, available for any party to compile and analyze.

1.3 Communications

It is recommended AENV work with the water users to develop a communications system to improve the operator's ability to match water deliveries with water demands and to reduce impacts of irregularities in diversion operations.

Sub-recommendations:

- ...[a water ordering system] developed in consultation with the irrigators would improve the supply-demand efficiency of the diversion system. Electronic communications should be considered.

AENV response:

- The recommendation is accepted; however, AENV is not prepared to engage in a lengthy or complex consultation process to develop a system.
- AENV is prepared to meet with a small number of representatives of the irrigators to try to develop a straightforward system that will work for all concerned.

1.4 Enforcement

It is recommended AENV enforce the allocations, and terms and conditions of licences and temporary licences in the Highwood and Little Bow River Basins.

Sub-recommendations:

- Periodic, random water audits should be conducted to ensure users are not diverting in excess of the licence allocations.
- AENV administrators should be receptive to, and encourage water rationing and deficit sharing in times of deficits...
- ...in the absence of a sharing arrangement, the priority system should be enforced.
- No temporary diversions should have priority over licenced uses or instream minimum flow requirements except possibly for municipal emergency use.

AENV response:

- Enforcement of provincial environmental legislation is the duty and responsibility of Alberta Environment. This it does to the best of its ability, subject to available resources and priorities.
- AENV does not agree with the statement in the related explanation to this recommendation that municipal emergency use should be considered as eligible for a temporary diversion licence (TDL) at the expense of others. There are other tools under the *Water Act* that provide the Minister with the authority to determine who gets water during an emergency and these should be used. If there are priority calls from licensees, TDLs will not be issued regardless of the purpose.
- Community involvement and support is essential in identifying unauthorized water use. The AENV hot line to report possible Water Act infractions is 1-800-222-6514.
- It is the licensees' responsibility to understand the terms and conditions of their respective licenses and ensure the diversion is within the parameters of their licences

and to act proactively in times of shortage to arrange assignments or transfers with others as a risk management tool.

- In times of deficit, it is suggested that an assignment under the *Water Act* would be a tool that could be used. The parties could agree to share the water and make recommendations to the Directors regarding under what circumstances TDLs could be issued. However, it is the Directors' decision on whether to issue a TDL under the *Act*. (TDLs are not assigned a priority like a normal licence.)

1.5 Role of Core Advisory Body from the Phase I Public Advisory Committee

It is recommended that AENV recognize a role for, and establish as an entity, a core group of the current Public Advisory Committee for the following purposes:

- **Oversee the timely implementation of the recommendations presented herein. Progress reports, prepared by Alberta Environment, on each and every recommendation should be provided to the core group at least once a year.**
- **Report to the Phase II PAC on Highwood Diversion Plan performance monitoring.**
- **Act as a sounding board for AENV administrators to test various ideas and options for implementation.**
- **Provide continuity and input to AENV in the conduct of Phase II of the Highwood Management Plan.**
- **To work with the Phase II group on setting Water Conservation Objectives.**
- **Provide AENV with a point of contact for public notification of allocation transfer applications, licence and temporary licence applications, and other significant water management issues in the Highwood and Little Bow River Basins.**

AENV response:

- The recommendation is generally accepted, but with the following qualifiers.
  - With NRCB final approval of the project, AENV recommends the PAC disband and form a Watershed Stewardship Group (WSG), consistent with the *Water For Life* strategy partnership framework. The WSG can be involved in and help to guide the goals/actions of the Bow River Basin Council as related to the Highwood River basin and the Oldman Watershed Council as related to the Little Bow River basin.
  - Concerning public notification of applications, TDLs and approvals, all authorizations, except for temporary diversion licences, can be viewed on the AENV website at: http://www3.gov.ab.ca/env/water/regions/Bow/notices/. Presently, this shows only applications and authorizations from the Calgary office for the Bow River basin (i.e., Highwood River). AENV will endeavor to have the Lethbridge office similarly post for the Oldman River basin (i.e. Little Bow River and Mosquito Creek).
  - The *Water Act* prescribes the requirements for notice to the public concerning applications and authorizations that AENV must follow.

Recommendations considered by the PAC to be important for future water management in the Highwood/Little Bow basins are as follows.

2.0 New Storage Development

It is recommended that development of the Super Expanded Women's Coulee storage site or any other similar major storage in the Highwood basin not be developed, pending further fishery field studies.

Sub-recommendation:

- The PAC strongly believes that before consideration is given to any storage in the Highwood Basin there is need for a comprehensive fishery field study on the whole Highwood system including its tributaries to determine the value of this fishery, and the validity of its aquatic habitat requirements and the recommended technical IFN (Recommendation 8.0).

AENV response:

- The recommendation is accepted.

3.0 Licence for the Pre-project Little Bow Diversion

It is recommended a licence for the pre-project 2.83 m^3/s (100 cfs) Little Bow Diversion be issued to the Crown in the Right of Alberta Environment.

AENV response:

- The recommendation is accepted.

4.0 Legal Status for the Highwood Diversion Plan

It is recommended the Highwood Diversion Plan be incorporated as an operation plan into Alberta Environment licences for the Women's Coulee and Little Bow Diversion works.

Sub-recommendations:

- Procedures for modifying the plan should be included as conditions on the licences.
- These conditions should be defined in consultations with the core group...
- Modifications that significantly affect performance in meeting objectives should be subject to public review and appeal.

AENV response:

- The recommendation is accepted.

5.0 Licensing Post-Little Bow Project Water Use

It is recommended that AENV continue to license projects using water from, and downstream of, the Twin Valley Reservoir in accord with the application and priority system under the *Water Act*. Licensing should not be limited solely to irrigation; other uses to consider include municipal, industrial and other (non-irrigation) agricultural uses. Total allocations for all uses shall not exceed the amount of water required for the irrigation of 6677 ha (16,500 acres).

Moratoria, with exempted uses similar to the existing moratoria, should be established under the *Water Act* for the Highwood River, Upper Little Bow River and Mosquito Creek. The moratoria should clearly state that licences for exempted uses, including temporary licenses, should be subject to the instream objectives for the Highwood River and the minimum operating flow targets for the Little Bow River and Mosquito Creek, consistent with the recommended Highwood Diversion Plan. The moratoria may be rescinded when Water Conservation Objectives have been established. (Recommendation 8.0).

Sub-recommendations:

- Existing moratoria should be revised to clarify instream requirements.
- ...applicants...be made aware of the risk...of water supply deficits...
- Informed applicants should be given the opportunity to withdraw their application, modify their project or proceed with the project as per their application.

AENV Response:

- With respect to licencing (first paragraph):
  - This recommendation is consistent with the proposed Crown Reservation (recommended in the South Saskatchewan River Basin Water Management Plan (SSRB WMP)) for the Bow, Oldman and South Saskatchewan River basins. It will permit allocations for the purposes of the Highwood/Little Bow project.
  - AENV will issue allocations for the volume of water represented by 6,677 ha (16,500 acres) of irrigation. This includes the small number of applications for non-irrigation purposes that were submitted during the moratorium period.
  - AENV agrees that applicants be directed to the modelling information to review the degree of reliability of the potential allocation and that applicants then have the opportunity to withdraw, modify or proceed with their application.

- With respect to moratoria (second paragraph):
  - The recommendations of the SSRB WMP will take precedence. The SSRB WMP states that applications for new allocations will no longer be accepted by AENV for the basins of the Bow, Oldman and South Saskatchewan Rivers. This supersedes the existing moratoria in place in the Highwood basin.
  - The SSRB WMP recommends a Crown Reservation of all unallocated water in the Bow, Oldman and South Saskatchewan River basins. Water could be allocated from the Crown Reservation for specific purposes to be identified in the Crown Reservation. The SSRB WMP also makes recommendations concerning WCOs for headwaters and tributaries.

- Generally, TDLs are already issued subject to IOs/WCOs.

6.0 Cancellation of Inactive Licences

It is recommended AENV cancel water licences that have not been used for a period of at least three years, and where there is no reasonable prospect for exercising the rights granted under the licence. The water should not be reallocated.

AENV response:

- The recommendation pertains to the legislated duties and responsibilities of AENV, which it performs to the best of its abilities, subject to available resources and priorities. AENV will continue to follow procedures as prescribed in legislation that have been established for review and cancellation of licences.
- The recommendation that water from cancelled water licences not be reallocated is consistent with the intent of the SSRB Approved Water Management Plan.

7.0 Licence Allocation Transfers

It is recommended licence allocation transfers (entire or partial) of mainstem Highwood River, Mosquito Creek, or Little Bow River water be permitted only after review of factors listed in the *Water Act*, and under the following conditions:

- **The seller and buyer are on the mainstem streams in the same sub-basin or stream reach (Highwood River, Upper Little Bow, Lower Little Bow and Mosquito Creek). For example, if the seller's licence is on Mosquito Creek, the buyer's licence should also be on Mosquito Creek.**
- **There is no adverse impact on environmental quality or other water users on the affected stream reach.**
- **Downstream transfers within the same reach are preferred, however, some upstream transfers within the same reach may also be acceptable where they have minimal instream and consumptive impacts and they provide for beneficial use. Transferring allocations from downstream of the Twin Valley, Clear Lake or Women's Coulee Reservoirs to upstream of those reservoirs would not be acceptable.**
- **Transfers for like purposes would be preferred, however, a change of use purpose may be acceptable provided that the withdrawal period for the new licence is within the same withdrawal period for the original licence.**
- **A licence dependent upon stored water in Twin Valley, Clear Lake or Women's Coulee Reservoirs (including downstream projects) should only be transferred to a buyer who will be dependent on the same stored water. For instance, an allocation using water from Twin Valley Reservoir or downstream (Lower Little Bow reach) should not be transferred to a user upstream of the Twin Valley Reservoir (Upper Little Bow reach).**
- **Public input is always sought. To help facilitate public input, the core group of the Phase I PAC and all licence holders within the same reach should be advised of transfer applications by either AENV or by the applicant (as directed by AENV).**
- **Transfers that would increase post-HDP diversions from the Highwood River**

during drought conditions, when the Highwood Instream Objectives or Water Conservation Objectives are not being met, are unacceptable. Increased future diversions from the Highwood River beyond the diversions in Scenario IDP8CS1 during critical low flow periods would further encroach on the Highwood IO or WCO and should be avoided.

- **Transfers to different water users should include a 10 percent holdback for the purpose of contributing to instream flow requirements. Transfers involving a licensee trying to improve efficiency of water use through relocation from one land location to a different but proximal land location owned by the same licensee should not include a holdback. Transfers of allocations that divert directly from a reservoir lake and that keep the new diversion point on the same reservoir should not include holdbacks as there is no instream benefit to be gained as along as the diversion remains on the reservoir.**

  Allocations from a reservoir or downstream of a reservoir should not be transferred to a location that is upstream of storage.

  Sub-recommendation:
  - …transfers for different purposes should not be ruled out where they have minimal instream and consumptive impacts, and provide benefits.
  - Allocations from a reservoir or downstream of a reservoir should not be transferred to a location that is upstream of storage.

  AENV response:

  - AENV appreciates the efforts of the PAC in developing the careful wording for these recommendations. The recommendations will be provided to the approvals directors for information and consideration in their review of applications. However, other factors also play a role in the decision making process as follows:
  - The Approved Water Management Plan for the South Saskatchewan River Basin includes Matters and Factors that the Directors must consider in considering an application for a transfer of a water allocation. These apply to the Highwood and Little Bow River basins. AENV Directors must consider each application for transfer of an allocation of water on its own merits and with due attention to the requirements of the *Water Act* and the matters and factors stated in the SSRB WMP.
  - The Directors consider all information available to them, which will include these recommendations. Some of the recommendations reflect decisions already made by AENV Directors concerning transfers of allocations of water. Others do not reflect the intents of the SSRB WMP and are unlikely to be carried into decisions. For example, transfers between like uses are unlikely to receive special consideration, as the intent of the SSRB WMP is to encourage water allocations to move to uses with the greatest economic benefit.
  - The subject of public notification of applications and decisions was addressed under Recommendation 1.5.

8.0 Highwood River Water Conservation Objectives and Moratoria

It is recommended that establishing Water Conservation Objectives on the Highwood River, Upper Little Bow River and Mosquito Creek be further explored. In the meantime, it is recommended that moratoria, with exemptions similar to the existing moratoria, be established for these streams. The moratoria must ensure that licences for exempted uses, including approvals for temporary uses on these streams, are subject to the same instream objectives and minimum operating flow targets that are inherent in the proposed Highwood Diversion Plan.
Sub-recommendations:

- The PAC feels that it cannot assign a WCO to the Highwood River until the technical Highwood IFN has been validated or revised, and a more comprehensive and integrated approach to establishing WCOs in the entire Highwood/Sheep/Little Bow system has been undertaken.
- ...IFN investigations be given a high priority in Phase II...
- ...moratoria should be established under the *Water Act* for the Highwood River Basin, Upper Little Bow and Mosquito Creek.
- Licences for exempted uses, including approvals for temporary uses, should be subject to Highwood River instream objectives and Little Bow River and Mosquito Creek minimum operation flow targets defined in the Highwood Diversion Plan.

AENV response:

- The recommendation is generally accepted, but with the following qualifiers:
  - The responses to Recommendation 5 also apply here.
  - As discussed under recommendation 9, priorities for future studies will be determined in discussions that include the Bow River Basin Council, the Oldman Watershed Council, the Highwood PAC/WSG, AENV and other partners.
  - The Directors may make decisions on WCOs in accordance with the *Water Act*, as discussed in Recommendation 1.1.

9.0 Highwood Management Plan – Phase II

It is recommended AENV proceed with Phase II of Highwood water management planning. The Phase II study should include, but not be limited to:

- **An integrated and validated instream flow requirement study of major streams and tributaries in the Highwood/Sheep/ Little Bow system to assist in the establishment of instream Water Conservation Objectives.**
- **Track monitoring assessments on Highwood Diversion Plan performance.**
- **Sheep River water supply and environmental issues.**
- **Groundwater issues and the relationships between surface water and near-by groundwater.**
- **Continue investigations into non-storage water management options.**

AENV response:

- As stated in the General Responses at the beginning, AENV agrees to place the accepted PAC recommendations into the form of a water management plan. This will

serve as a concise guideline for the basin and as a platform on which future watershed management planning can be built.

- The need and priorities for additional studies and planning specific to the Highwood and Little Bow River basins will be determined in discussion between the proposed Highwood WSG, the Bow River Basin Council, the Oldman Watershed Council and AENV.
- AENV is in the process of revising the *Framework for Water Management Planning* to incorporate watershed management planning (that is, land management as it affects water quantity and quality). Watershed management planning will involve a much greater degree of cooperation and integration among all the authorities with jurisdiction over land and water.
- Tracking of performance of the diversion plan would naturally fall within the scope of the suggested WSG.
- Continued investigation of non-storage water management options is to be encouraged. This has also been identified as important by the SSRB WMP for the whole of the Bow, Oldman and South Saskatchewan basins. The Highwood WSG and the Bow River Basin Council and Oldman Watershed Council could coordinate efforts to improve the efficiency and effectiveness of water use.

Appendix E

Information Sheet

Information for Licence Holders and Others Interested in Water Management in the Upper Highwood and Upper Little Bow River Watersheds

Note:
For purposes of this Information Sheet, the Upper Highwood River watershed is defined as the watershed above the confluence of the Highwood and Sheep Rivers. It does not include the Sheep River watershed. The Upper Little Bow River watershed is defined as the watershed of the Little Bow River above the Travers Reservoir.

Alberta Environment (AENV) wishes to provide the following information to licence holders and others with an interest in water management in the watersheds of the Upper Highwood and Upper Little Bow watersheds. This is in response to the recommendations of the Highwood Public Advisory Committee.

Water Management During Shortage

During water shortages, the need for careful management and use of water increases greatly. One key step is for the community to assist in identifying unauthorized water use. Possible Water Act infractions should be reported to the AENV hot line: 1-800-222-6514.

It is the licensees' responsibility to understand the terms and conditions of their respective licenses and ensure their diversions are within the parameters of their licences and to act proactively and have a plan for dealing with water shortages. This could include arranging in advance assignments and water allocation transfers, water storage and water conservation.

Information Concerning Public Notice of *Water Act* Applications, Decisions, Authorizations and Approvals

The *Water Act* and the *Water (Ministerial) Regulation* sets out specific requirements for public notice of applications and decisions.

Water Act notices are posted on AENV's website at:
http://www3.gov.ab.ca/env/water/Regions/Bow/Notices/files/5322.html

Presently, the the AENV website shows only notice of applications and decisions from the Calgary District for the Bow River basin (i.e., Highwood River basin). The Lethbridge District will be arranging to also post notice of applications and decisions for the Oldman River basin (i.e., Little Bow River basin).

Authorizations and Approvals (for all Alberta) can also be viewed on the AENV website at:
http://www3.gov.ab.ca/env/water/approvalviewer.html

Information Concerning Diversions from the Highwood River and Protection of the Fishery

Highwood River dissolved oxygen and water temperature can be viewed on the AENV website. This gives water users access to the information to help them make decisions on measures that could be taken to aid the resource.

The website for the data is: http://www3.gov.ab.ca/env/water/ws/data/stnreport/tables/BOW-WHIWALD-ST.txt

Water Use Monitoring and Reporting

Knowledge of actual water use will be of great use in improving water management in the future for the overall betterment of the watershed. Licence holders are encouraged to participate in voluntary water use reporting to aid in future planning.

Licensees are still required to comply with the monitoring and reporting requirements as set out in their respective licences.

- Licensees can voluntarily sign on to the website and electronically report their water use under licence.
- The website is: http://www3.gov.ab.ca/env/water/wur/submission.html
- Existing licensees can also submit their water use returns in paper format.

All new licences issued require measurement and recording of water diversion. This also applies to new licences that are issued as a result of transfers. AENV anticipates that in the future all water use and return flows will be reported electronically.

Management and Protection of Riparian Vegetation

Achievement of healthy riparian environments along the Little Bow River requires appropriate management by landholders. AENV does not manage the land alongside rivers, streams and other water bodies. Landholders are encouraged to contact the Cows and Fish Program for advice or to consider preparing Environmental Farm Plans.

Appendix F

Documents in which PAC Recommendations are Addressed

Highwood Public Advisory Committee Recommendations	Addressed In:					
	HDP*	WMP✖	WMP Info Sheet (App. F)	MP✦	AENV Response•	SSRB WMP◇
1.0 Highwood Diversion Plan Without Storage	✓				✓	
Contingent Measures:						
1.1 Irrigation Licences with July Cutoffs		✓	✓		✓	
1.2 Performance Monitoring for Adaptive Management				✓	✓	
1.2a Water Quality Monitoring				✓	✓	
1.2b Highwood River Fishery Water Temperature and Dissolved Oxygen Operating Criteria	✓		✓	✓	✓	
1.2c Riparian Habitat	✓		✓	✓	✓	
1.2d Water Use Monitoring and Reporting			✓		✓	
1.3 Communications		✓			✓	
1.4 Enforcement					✓	
1.5 Role of Core Advisory Body from the Phase I Public Advisory Committee					✓	
Recommendations considered by the PAC to be important for future water management in the Highwood/Little Bow basins:						
2.0 New Storage Development					✓	
3.0 Licence for the Pre-project Little Bow Diversion		✓			✓	
4.0 Legal Status for the Highwood Diversion Plan		✓			✓	
5.0 Licensing Post-Little Bow Project Water Use		✓			✓	
6.0 Cancellation of Inactive Licences					✓	
7.0 Licence Allocation Transfers		✓			✓	✓
8.0 Highwood River Water Conservation Objectives and Moratoria		✓			✓	✓
9.0 Highwood Management Plan – Phase II		✓			✓	✓

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* Revised Highwood Diversion Plan
✖ Water Management Plan for the Watersheds of the Upper Highwood and Upper Little Bow Rivers
✦ Monitoring Plan
• AENV Response to the PAC's recommendations for the HDP
◇ Approved Water Management Plan for the South Saskatchewan River Basin

Water Management Plan for the Watersheds of the Upper Highwood* and Upper Little Bow** Rivers

Volume 2

HIGHWOOD DIVERSION PLAN

March 2008

* Above confluence with Sheep River
*Above Travers Reservoir

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Introduction

This plan replaces the document entitled "Interim Highwood Diversion Plan – March 9th, 2004 and the Highwood Operations Guidelines. This plan has been prepared to meet the Water License requirements for the project. This revised diversion plan includes changes relating to adopting a new Instream Objective curve for flows greater than 7.6 m^3/s (268 cfs), and a drought operation rule. The revisions are based on the recommendations from the Highwood Management Plan Public Advisory Committee documented in the Highwood Water Management Plan, Phase 1; Final Report June 2006.

The diversion rates and operating rules laid out in this plan are meant to define the upper and lower limits of operation. It is the Bow Operations Manager's duty to coordinate and adjust, wherever possible, the day to day operation of Highwood Diversion systems under this plan with the findings and recommendations of the Highwood Diversion Water Quality and Riparian Vegetation Monitoring Programs being carried out currently.

This plan shall be reviewed annually with respect to contact numbers and organizational responsibilities.

Objectives

The objectives of the Highwood Diversion Plan are as follows:

1. Operate the Little Bow Project, including the Twin Valley Dam and Clear Lake Diversion as approved;
2. To meet the existing licensed demands at least as frequently as they are met under Base Case conditions;
3. To preserve the water quality in the upper Little Bow River and lower Mosquito Creek;
4. Manage the impact of the new flow regime in the Upper Little Bow and
5. Improve instream flow conditions for fish in the lower Highwood River.

General Operating Rules

Diversions from the Highwood River and Mosquito Creek

The three diversions covered under this plan are Women's Coulee and Little Bow from the Highwood River and Clear Lake from Mosquito Creek. Figure 1 shows the location of each of the diversion systems and significant structures within the Highwood and Little Bow River basins.

The general rules for operation of these facilities are outlined in Tables 1, 2 and 3, and Figure 2. They identify priorities and flow rates at the diversions for different periods of the year.

Table 1 Priority of Objectives

1	Pre-project Highwood, Little Bow and Mosquito Creek non-irrigation licence commitments. This includes municipal and industrial demands.
2	Pre-project Highwood Irrigation in the Highwood River basin. These are senior licences that represent a major consumptive use. They are not subject to any instream objectives.
3	1994 Highwood Operating Guidelines (January 1 to December 31). The guidelines are not a legal requirement, but were agreed upon by Alberta Environment and licensees in the late 1980s (revised in 1994).
4	Pre-project full season irrigation licenses along the Little Bow River and Mosquito Creek.
5	Pre-project irrigation licenses with cut-off dates along the upper Little Bow River and Mosquito Creek. These licences are generally junior to the full licenses.
6	Target Operating Minimum Flows: Upper Little Bow 0.566 m^3/s (20 cfs) from Oct 31st to April 30th, 0.85 m^3/s (30cfs) from May 1st to Sept 30th and Mosquito Creek 0.283 m^3/s (10 cfs) non-winter only
7	Pre-project irrigation licenses along the upper Little Bow River and Mosquito Creek with cut-off dates extended.
8	Inflow to Travers Reservoir 0.566 m^3/s (20 cfs year round)
9	Women's Coulee Reservoir storage
10	Pre-project irrigation licenses along the lower Little Bow River with cut-off dates extended.
11	Highwood River instream requirements as defined in Table 2 Stages 6 & 7
12	Target environmental flows for upper Little Bow, 1.133 m^3/s (40 cfs) and Mosquito Creek upstream of the Clear Lake diversion, 0.85 m^3/s (30 cfs)
13	Clear Lake irrigation expansion projects
14	Lower Little Bow irrigation expansion projects
15	Clear Lake wetlands
16	Clear Lake storage
17	Twin Valley Reservoir storage

Note: The objectives of the project are prioritized in Table 1. These objectives are based upon the model scenario recommended in the Highwood Water Management Plan, Phase 1; Final Report June 2006 and have priorities which differ slightly from the Water – Act priority list, in that non –irrigation uses are given a higher priority because of their limited affect. During periods of low flow, should objections be raised, the Water - Act priorities always take precedence.

These diversions supply water to Women's Coulee Reservoir, Clear Lake and Twin Valley Reservoir. The general operations of these reservoirs are outlined briefly in regard to their impact under this diversion plan. More specific detail regarding the operation of the Clear Lake and Twin Valley Reservoirs can be found in the respective Operation, Maintenance and Surveillance Manuals

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Highwood River: and Mosquito Creek Diversions

Figure No. 1

Table 2 Operating Periods, Maximum, Minimum Diversion Rates, Target Environmental Flow and Minimum Operation Flows

Diversion	Operation / Irrigation Season			Winter Season
	Apr 1 – Apr 30	May 1 – July 15	July 16 – Sept 30	Oct 1 – Mar 31
Women's Coulee Diversion, Canal & Mosquito Creek				
Maximum Diversion Rate[1]	1.70 m^3/s	1.70 m^3/s	1.70 m^3/s	0.283 m^3/s [Note 2]
Target Environmental Flow[3]	0.85 m^3/s	0.85 m^3/s	0.85 m^3/s	N/A[9]
Minimum Operation Flow[4]	0.283 m^3/s	0.283 m^3/s	0.283 m^3/s	N/A[9]
Clear Lake Diversion[6]				
Maximum Diversion Rate[5]	1.70 m^3/s	1.70 m^3/s	1.70 m^3/s	0.0 m^3/s
Little Bow Diversion, Canal and Upper Little Bow				
Maximum Diversion Rate[7]	8.5 m^3/s	8.5 m^3/s	8.5 m^3/s	0.566 m^3/s or 50% of natural flows in the Highwood River, whichever is less.
Minimum Diversion Rate	0.566 m^3/s or 50% of natural flows in the Highwood River, whichever is less.			
Target Environmental Flow	1.133 m^3/s	1.133 m^3/s	1.133 m^3/s	N/A[9]
Minimum Operation Flow[8]	0.566 m^3/s	0.850 m^3/s	0.850 m^3/s	0.566 m^3/s
Twin Valley Releases to Lower Little Bow				
Minimum Operation Flow[10]	0.566 m^3/s			

Notes:

[1] Subject to Highwood River Instream Objective rules described below. Flow is metered at the diversion near the Highwood River.

[2] Emergency winter supply (e.g. Village of Cayley)

[3] Measured at Mosquito Creek upstream of Clear Lake Diversion.

[4] Calculated upstream of Twin Valley Reservoir.

[5] Subject to the minimum operation flow being met for Mosquito Creek

[6] There are no target environmental or minimum operation flows for the Clear Lake Diversion or canal.

[7] Subject to Highwood River Instream Objective rules described below. Flow is metered at the Little Bow diversion near the Highwood River.

[8] Upstream of Twin Valley Reservoir.

[9] Not applicable because there will be no winter diversions except during emergencies.

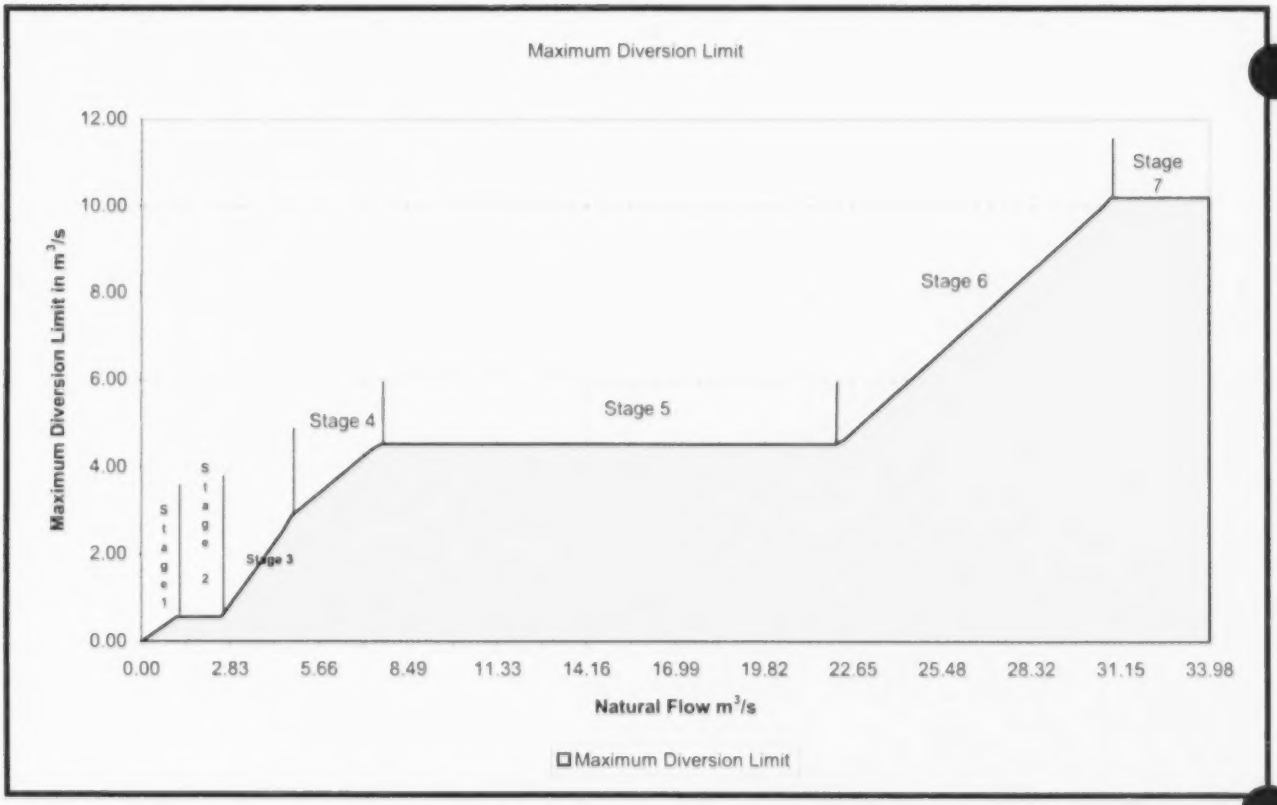
[10] Measured upstream of Travers Reservoir

The Highwood River Instream Flow Objectives used in this Diversion Plan vary according to the natural flow in the Highwood River. Table 3 and Figure 2 detail the allowable maximum diversion limits for the ranges of river flow.

Table 3 Highwood River Instream Flow Objectives Vs Diversion Limits

Stage	Highwood River Natural Flow at Highwood River Below Little Bow Canal diversion	Maximum Diversion Limit for (Women's Coulee Diversion and Little Bow Canal Diversion)	Comments
Stage 7	Natural Flow > 31 m^3/s	10.19 m^3/s	Described as Rule #3 in the Highwood Water Management Plan, Phase 1
Stage 6	22.23 m^3/s to 31 m^3/s	65% of natural flow less 9.91 m^3/s	
Stage 5	7.65 m^3/s to 22.23 m^3/s	4.53 m^3/s	Limit of Pre – 1994 licenses
Stage 4	4.9 m^3/s to 7.65 m^3/s	60% of Natural Flow	
Stage 3	2.55 m^3/s to 4.87 m^3/s	Natural flow less 1.98 m^3/s	
Stage2	1.13 $m^3/s$to 2.55 m^3/s	0.566 m^3/s	Based on 1994 Operation Guidelines
Stage 1	< 1.13 m^3/s	50% of Natural Flow	

Figure 2 Highwood River Instream Flow Objectives Vs Diversion Limits



Special Operational Requirements

Normal diversions will be managed in accordance with the General Operating Rules. However, three special operating requirements have been established where diversions will be managed to address:

- Highwood River Stress Conditions
- Drought Conditions
- Flood Conditions

In addition, when conditions are suitable, diversions will be managed to improve the aquatic and riparian environment. Prior to reaching any of these conditions an **Alert Condition** will be declared. The procedures and condition for declaring an **Alert Condition are** given in Appendix B.

1. Highwood River Stress Conditions

The Highwood River is defined to be under stress, during the conditions described below, at which time the operations will be modified accordingly.

1. Low flow conditions

   Low flows exist in the Highwood River when the residual or through flow in the Highwood River, downstream of the Little Bow Canal, is 4.25 m^3/s (150 cfs) or less. At this point every attempt will be made to keep the flow in the Highwood River downstream from the Little Bow Canal Diversion from continuing to fall by ensuring that no more water than is absolutely necessary to meet domestic and licensed municipal, irrigation and industrial uses is diverted from the Highwood River. In order to assist in achieving this objective, the following will be undertaken:

   1. Any temporary irrigation license extensions in effect will be suspended.

   2. User demands, water temperature and dissolved oxygen at Aldersyde and flows at the Little Bow River gauging station at Hwy. 533, will be closely monitored with the aim of targeting flows into Twin Valley Reservoir to 0.566 m^3/s (20 cfs) or lower if the natural flow in the Highwood River is below 1.13 m^3/s (40 cfs).

2. Temperature and Oxygen Stress

   Temperature and Oxygen stress in the Highwood River are defined to occur when:

(i) water temperature in the Highwood River below the Town of High River (specifically at Water Survey station - Highwood River at Aldersyde datasonde) exceeds 24 C

Or

(ii) dissolved oxygen in the Highwood River below the Town of High River is less than 5 mg/L. (specifically at datasonde at Aldersyde).

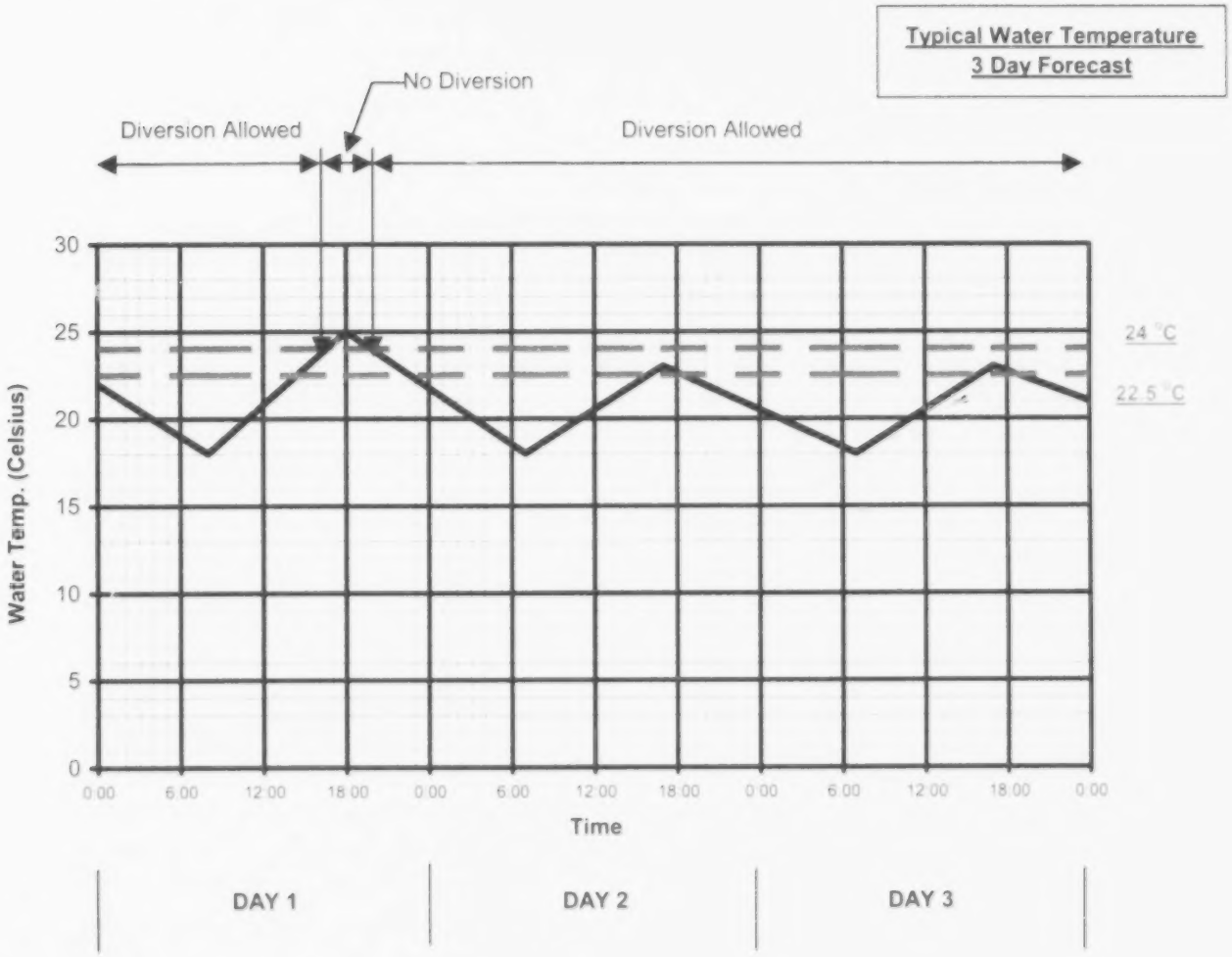
Should either of these conditions be met, diversions for irrigation during normal and drought operations will be temporarily suspended, the Little Bow Diversion from the Highwood will be limited to a maximum of 0.566 m^3/s (20 cfs) or 50% of the natural flow when the flow is less than 1.13 m^3/s (40 cfs) and the Women's Coulee Diversion will be shut down:

In order to prevent destabilizing canal banks due to the rapid draw down of water levels when diversions are cut to minimums during water temperature or oxygen stress conditions, diversion rates may be cut back in a series of steps when the water temperature reaches 22.5 C or the dissolved oxygen is less than 5.5 mg/L. At this stage an "ALERT CONDITION" will be issued and irrigators will be notified immediately regarding the possibility of diversion cutbacks.

Should Highwood River water temperatures continue to rise past 24 C, or oxygen levels continue to drop below 5.0 mg/L, diversions for irrigation will be temporarily suspended. Resumption of diversions for licensed irrigation will be contingent upon the evaluation of the 3 day water temperature, the oxygen level forecast and the 3 day river flow forecast as described in the following Scenarios:

Scenario 1

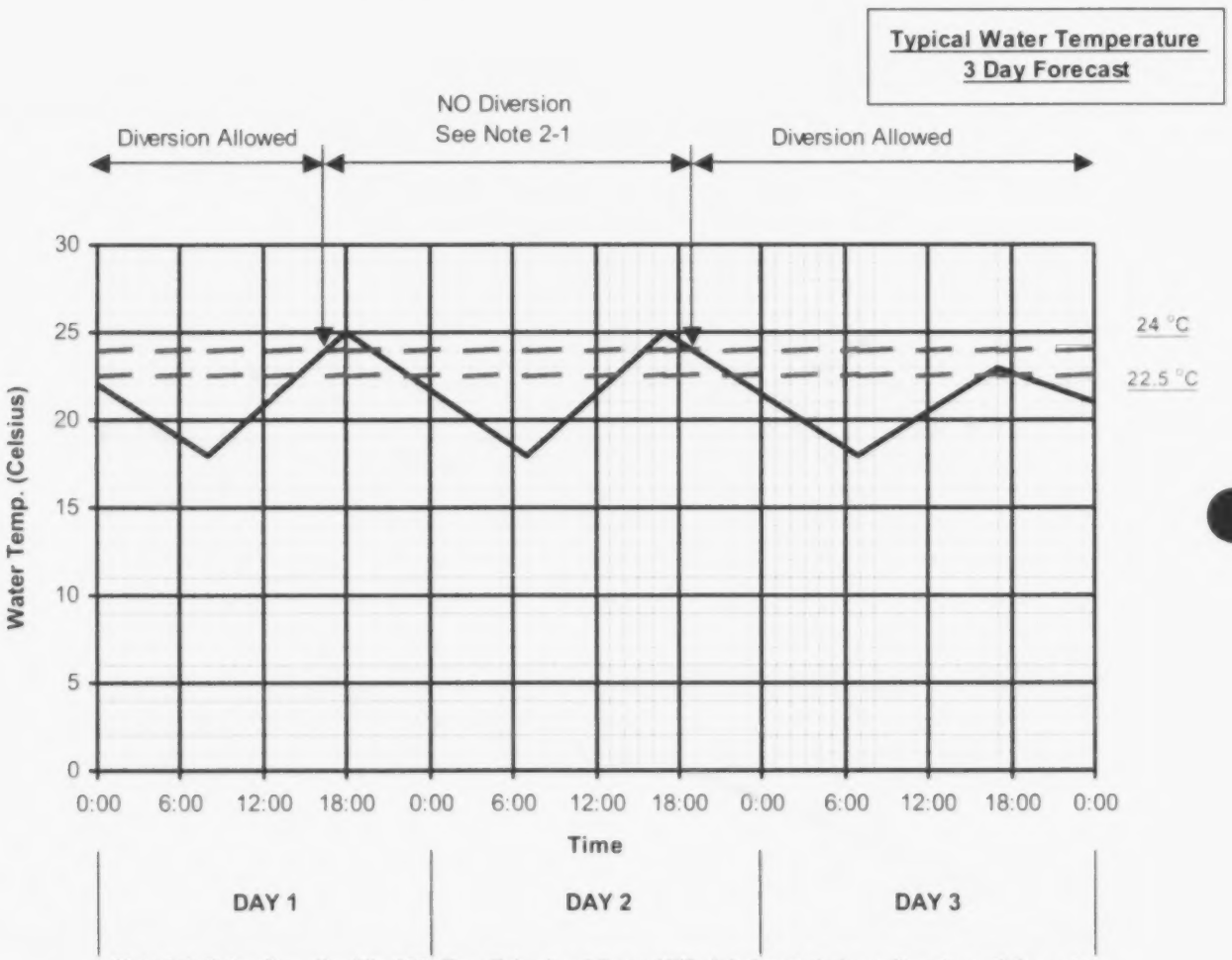
If the water temperature forecast does not exceed 24 °C during the next 24 hours regardless of the river flow downstream the diversions can resume when the water temperature falls below 24 C according to the diversion rates specified in Table 3.



Note: 22.5 C Alert Condition
24 C Stress Condition

Scenario 2

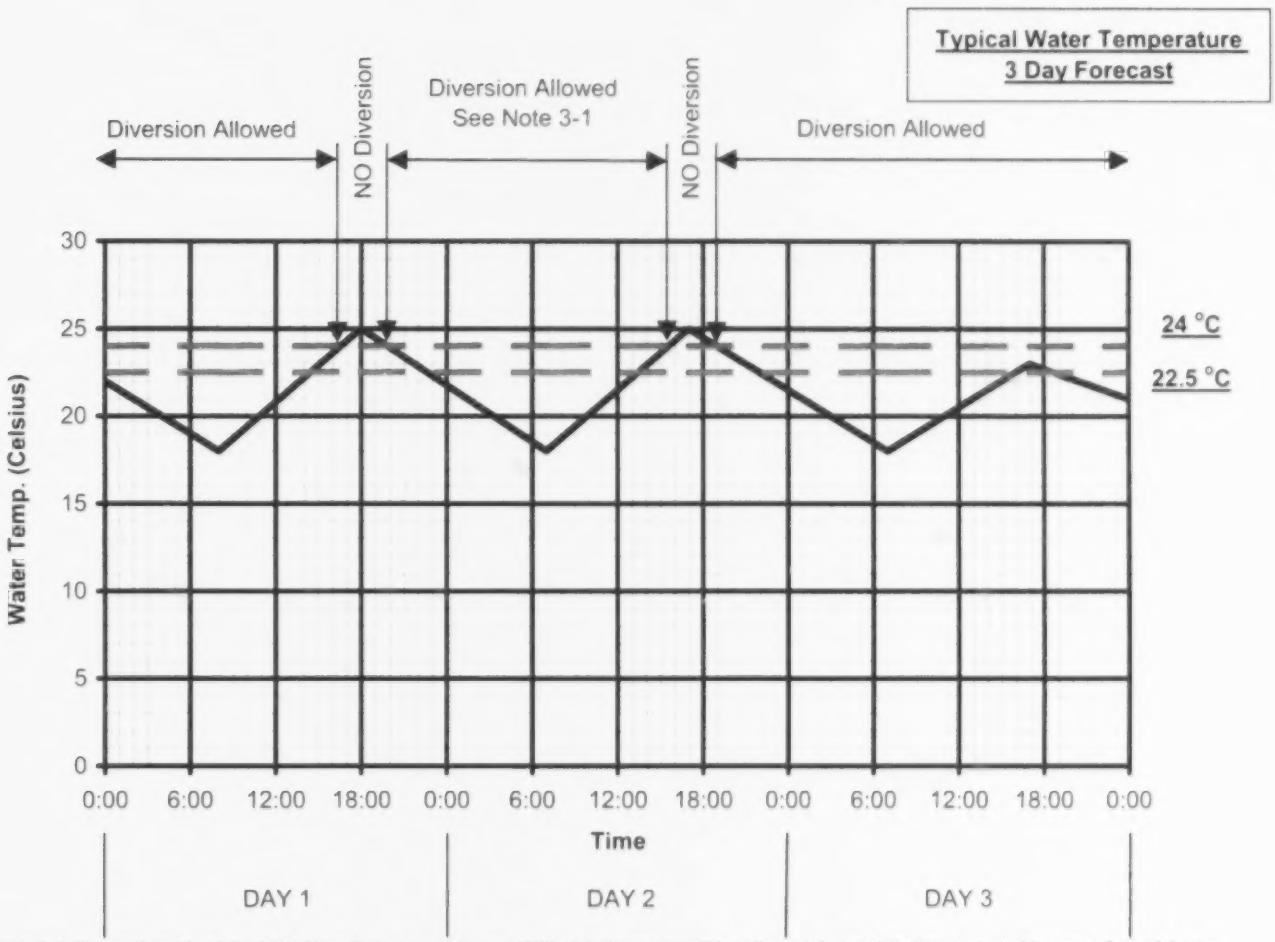
If the water temperature forecast does exceed 24°C during the next 24 hours or longer and a minimum river flow downstream of the Little Bow Diversion gates of 4.2 m^3/s (150 cfs) cannot be maintained, then diversions cannot be resumed until the actual and the forecast water temperature falls below 24°C.



Note 2-1: If river flow d/s of the Little Bow Gates is < 4.2 cms (150 cfs); do not start any diversion until the water temperature forecast for the following day is below 24 °C

Scenario 3

If the water temperature forecast does exceed 24°C for the next 24 hours or longer and the river flow downstream of the Little Bow Diversion gates can be maintained at 4.2 m^3/s (150 cfs) or higher, then diversions can be resumed when the water temperature drops below 24°C.



Note 3-1: If river flow d/s of the Little Bow Gates is > 4.2 cms (150 cfs); diversion will be allowed during this time period. Minimum flow of 4 cms (150 cfs) downstream of Little Bow Gates should be maintained and the conditions in Tables 2 and 3 should be followed

2. Drought Conditions

In the first year of a drought, operation will be as described in the General Operating Rules. In the 2nd and 3rd years of successive drought some diversion for reservoir recharge will be allowed. The following parameters define the drought condition:

Table 4. Definition of Drought Conditions

River Basin	March 1st to September 30th Volume Forecast (issued May 1st)		Reservoir Water Level on May 1st	
			Clear Lake	Twin Valley Reservoir
Mosquito Creek	< 300 000 dam^3			
	OR			
	< 400 000 dam^3	AND	< 965.0 m	
Little Bow	< 400 000 dam^3		AND	< 957.0 m

During times of successive drought as defined above the minimum target flows for Mosquito Creek and Little Bow River will be as follows during years 2 and 3:

Table 5. Minimum Target Flows During Drought Conditions

System	Mosquito Creek d/s Clear Lake Diversion	Little Bow River u/s Twin Valley Reservoir	Little Bow River u/s Travers Reservoir
April 1st – 30th	0.283 m^3/s	0.566 m^3/s	0.566 m^3/s
May 1st – July 15th	0.850 m^3/s	2.124 m^3/s	0.566 m^3/s
July 15th – Sept 30th	0.283 m^3/s	0.850 m^3/s	0.566 m^3/s
Oct 1st – March 31st	0.283 m^3/s	0.566 m^3/s	0.566 m^3/s

Diversions under drought conditions are subject to Highwood River stress conditions.

3. Flood Conditions

During flood conditions the diversions will be managed and operated to avoid or minimize downstream flooding and damages wherever possible. The conditions of the downstream reservoirs and their operations are a major consideration in deciding diversion flows during and immediately after flood events.

Other Considerations

Freshening Flows

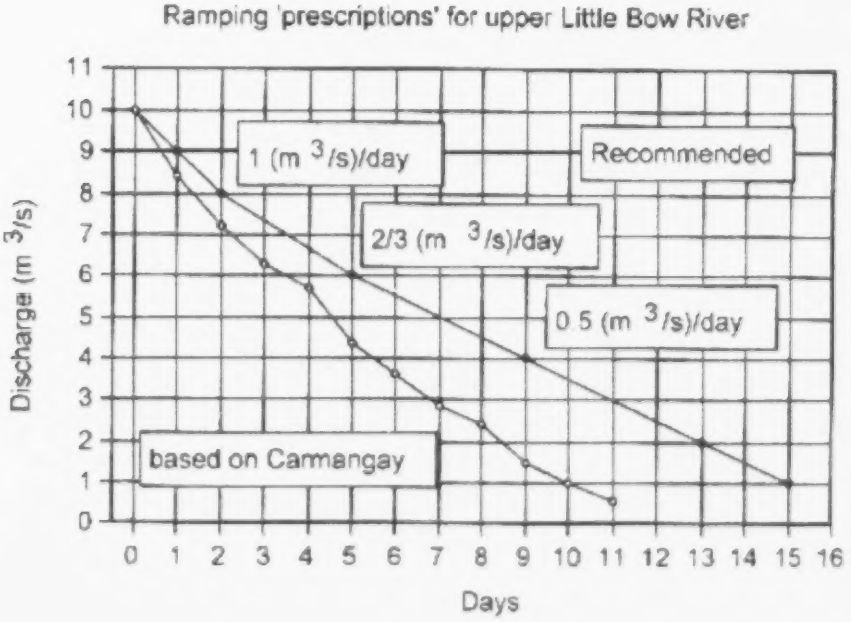
When water is available in the Highwood River, diversions will be increased as necessary to provide a freshening flow to improve the quality of water in Mosquito Creek and the Little Bow River for domestic and municipal use. In these cases, the total diversion will be up to 4.53 m^3/s (160 cfs) spring and up to 1.42 m^3/s (50 cfs) in the summer and fall.

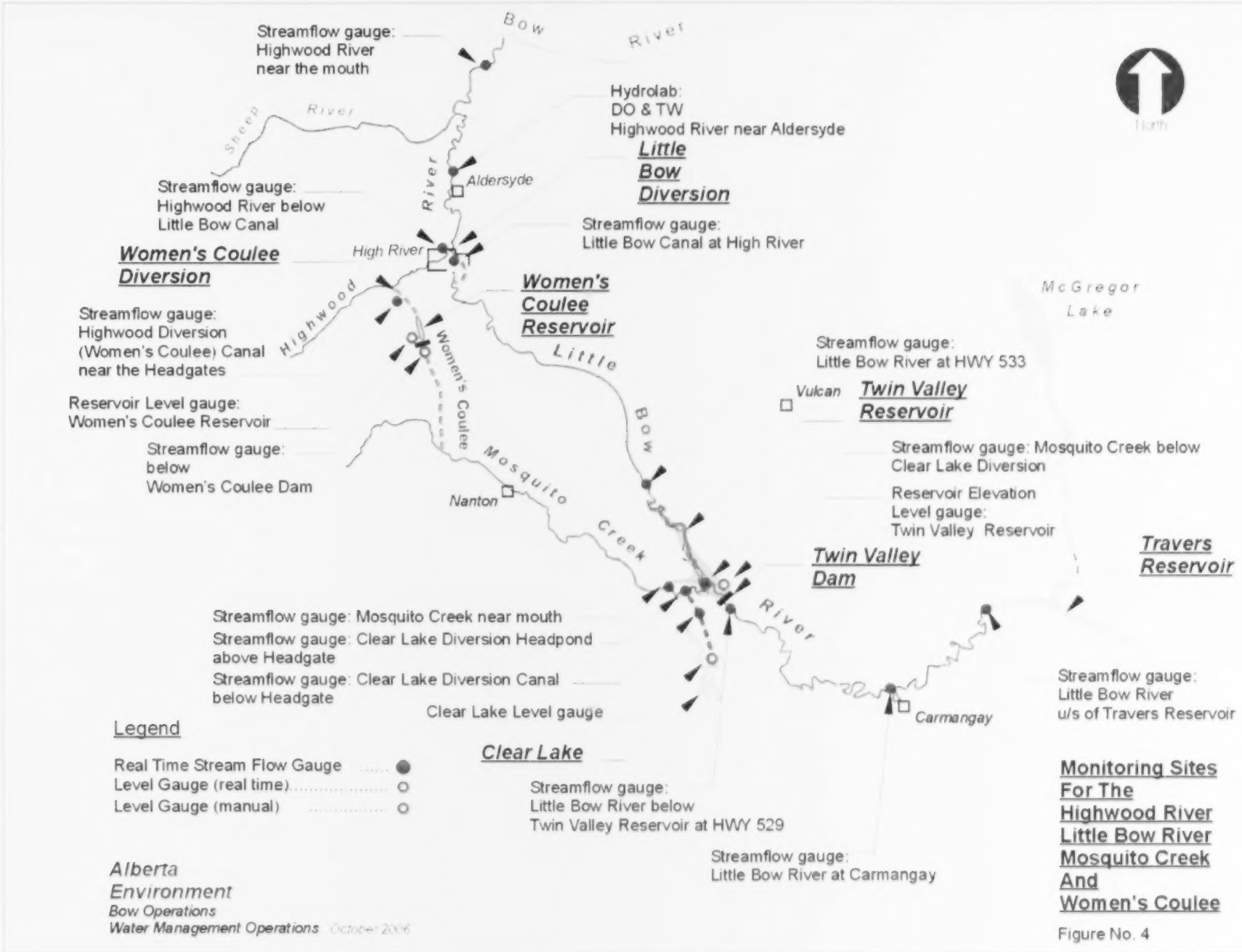
Riparian Habitat Management

In order to minimize any impact and enhance the riparian habitat between the 2.83 m^3/s (100 cfs) and 8.49 m^3/s (300 cfs) flow areas in the upper Little Bow and whenever the Highwood River flow conditions are favourable, abrupt changes in flow will be avoided in the upper Little Bow. Instead, changes will be in a step down fashion of approximately 2 – 4 cm of flow depth per day or in terms of flow as per Figure 3. It should be understood that this might not always be possible under flood conditions, sharp drops in river flows, or stress conditions. As mentioned above, this ramping will only apply when diversion flows are above 2.83 m^3/s (100 cfs). Achieving ramping down may also be difficult when there is a significant natural base flow condition in the Little Bow River downstream of the diversion.

The above guidelines may be modified depending upon the recommendations of the Highwood Diversion monitoring program.

Figure 3 Recommended Ramping Down Flows For the Upper Little Bow River


Ramping 'prescriptions' for upper Little Bow River
Discharge (m 3/s)
Days
1 (m 3/s)/day
2/3 (m 3/s)/day
0.5 (m 3/s)/day
Recommended
based on Carmangay
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 1 2 3 4 5 6 7 8 9 10 11


Streamflow gauge:
Highwood River
near the mouth
Bow River
Hydrolab:
DO & TW
Highwood River near Aldersyde
Little Bow Diversion
Sheep River
Aldersyde
Streamflow gauge:
Highwood River below
Little Bow Canal
Streamflow gauge:
Little Bow Canal at High River
Women's Coulee Diversion
High River
Women's Coulee Reservoir
McGregor Lake
Highwood
Streamflow gauge:
Highwood Diversion
(Women's Coulee) Canal
near the Headgates
Women's Coulee
Little Bow
Streamflow gauge:
Little Bow River at HWY 533
Vulcan
Twin Valley Reservoir
Reservoir Level gauge:
Women's Coulee Reservoir
Streamflow gauge:
below
Women's Coulee Dam
Mosquito Creek
Streamflow gauge: Mosquito Creek below
Clear Lake Diversion
Nanton
Reservoir Elevation
Level gauge:
Twin Valley Reservoir
Travers Reservoir
Twin Valley Dam
Bow River
Streamflow gauge: Mosquito Creek near mouth
Streamflow gauge: Clear Lake Diversion Headpond
above Headgate
Streamflow gauge: Clear Lake Diversion Canal
below Headgate
Clear Lake Level gauge
Carmangay
Streamflow gauge:
Little Bow River
u/s of Travers Reservoir
Legend
Real Time Stream Flow Gauge
Level Gauge (real time)
Level Gauge (manual)
Clear Lake
Streamflow gauge:
Little Bow River below
Twin Valley Reservoir at HWY 529
Streamflow gauge:
Little Bow River at Carmangay
Alberta Environment
Bow Operations
Water Management Operations October 2006
Monitoring Sites For The Highwood River Little Bow River Mosquito Creek And Women's Coulee
Figure No. 4

Reservoir Operation

Women's Coulee

The Women's Coulee reservoir is used to meet irrigation demands from April 1st to September 30th. When the Highwood River is under stress conditions, depending on the availability of water, releases from the reservoir will be made to meet the needs as per the list of priorities. During this time the reservoir will not be used to meet the minimum operational flow requirements in Mosquito Creek. However, outside of stress conditions, depending on the river flow forecast, the reservoir will be used to help meet the minimum flow requirements in Mosquito Creek.

Clear Lake Project

The operation of the Clear Lake Project is detailed in the Clear Lake Operation, Maintenance and Surveillance Manual (Alberta Transportation, January 2001). Subject to the limits detailed in Table 2, water may be diverted from Mosquito Creek to fill storage in Clear Lake and fill the habitat ponds along the canal and adjacent to the lake. The habitat ponds are to be filled between September 15th and October 30th, once the nesting season is over. If insufficient water was available to fill the wetlands in the fall then they can be filled in the very early spring provided that there is sufficient water available, migratory shoreline waterfowl have not returned to the area yet and Ducks unlimited is in agreement with the operation. The lake has a full supply level of 966.3m and a minimum operating elevation of 964.5m to protect recreational use and fish populations in the lake.

Twin Valley Dam and Reservoir

The operation of the Twin Valley Reservoir is detailed in the Little Bow River Project Operation, Maintenance and Surveillance Manual (Alberta Transportation, April 2004). The Twin Valley Dam and Reservoir is intended to meet existing demands downstream of the reservoir, permit the elimination of cut-off restrictions on existing licenses downstream of the reservoir, and support irrigation of an additional 6 677ha (16,500 acres) of land directly from the reservoir and downstream of the reservoir from water released to the Little Bow River. During the April 1st to October 31st operating season, pre-project licenses downstream of the reservoir have priority over reservoir filling. Any water in excess of these demands may be stored for later release to meet downstream demands. The reservoir has a full supply level of 964.8 m and an operating minimum elevation of 950m. Normal operation is to be by the low level outlet, which has an operating capacity of 8.49 m^3/s (300 cfs). When the reservoir is at, or near, full supply level and the inflows exceed the capacity of the low level outlet; water will be released over the service spillway.

Flow Measurement

The flow measurement sites pertinent to this plan are shown on Figure 4. Definitions of different types of flows in this diversion plan are included in Appendix A. Alberta Environment's Water Management Operations will use Operating Flows to adjust diversion rates to meet the requirements of this plan unless Measured Flow information is available. A weekly record of the natural and operating flows will be published on Alberta Environment's web site under the title of Highwood River Weekly Streamflow Report. It is important to note that the flows noted in the report may vary from the final official recorded flows published by Water Survey of Canada (WSC). The reason for this is that the operating flow record does not account for after the fact shift corrections in the data.

1. Accuracy of Flows

Should it become apparent at anytime that there is an anomaly in the real time or computed operation flows the Bow Operations Technologist will contact monitoring personnel and request that a measured flow be taken for the site in question.

Due to variations in climatic conditions and the fact that some gauging stations are shut down during the winter months the following will apply.

WINTER FLOWS (Oct. 1 to Apr. 30)

1. The accuracy of winter operating flows is ±25%. Any flows computed between 0.425 – 0.708 m^3/s (15 – 25 cfs) are assumed to be within an acceptable range of the targeted winter flow of 0.566 m^3/s (20 cfs) at the Little Bow Canal Headgates. Every effort will be made to limit the total weekly diversion volume to 345.38 dam^3 (280 acre feet).

2. Flows will be computed on a daily basis. Alberta Environment's Monitoring group will be responsible for winter flow being measured on the Little Bow Canal and the Highwood River bi-weekly.

3. When the natural flow in the Highwood River at High River drops below 1.70 m^3/s (60 cfs), icing conditions exist, or operation complications dictate, Alberta Environment's Monitoring group will increase the frequency of measurement, as required, in order to attempt to maintain the accuracy of operating flows within ±25%.

SUMMER FLOWS (May 1 to Sept. 30)

1. The accuracy of summer operating flow is ± 10%.

2. Alberta Environment's Monitoring group will be responsible for ensuring that summer flows are measured in the Little Bow Canal, Women's Coulee and the Highwood River once every 3 weeks.

3. When the natural flow in the Highwood River at High River drops below 8.5 m^3/s (300 cfs) or river stress guidelines are in force, Alberta Environment's Monitoring group will increase the frequency of measurements as required in order to attempt to maintain the accuracy of operating flows within ±10%.

2. Data verification during stress conditions

As noted previously, Alberta Environment's Monitoring group may be requested to verify datasonde temperature readings at the Highwood River Near Aldersyde station with manual readings and confirm the data with the Bow Operations Technologist.

3. Station Names

Alberta Environment real time hydrometric data can be found on the Alberta Environment web site under Alberta River Basins. Hydrometric stations identified in Figure 4 are tabulated below along with the type of hydrometric measurement being logged.

Table 6. Hydrometric Stations

Station Name	New Leaf Code	Type of Gauge
RHIWMOU	High River near the mouth	Streamflow
WHIWALD	Highwood River near Aldersyde	DO and TW
RHIWLBOW	High River below Little Bow canal	Streamflow
RLBOWHIR	Little Bow Canal at High River	Streamflow
RHIWDIV	Highwood Diversion Canal near the Headgates	Streamflow
RSQUARES	Women's Coulee Reservoir	Level
RSQUAOUT	Women's Coulee Diversion below Women's Coulee Dam	Streamflow
RLBOW533	Little Bow River at Highway 533	Streamflow
RMOSQMOU	Mosquito Creek near the mouth	Streamflow
RCLEADIV	Clear Lake Diversion Headpond above Headgates	Level
RMOSQDIV	Mosquito Creek below Clear Lake Diversion	Streamflow
RCLEACNL	Clear Lake Diversion Canal below Headgates	Streamflow
RTWINRES	Twin Valley Reservoir	Level
RLBOWTWI	Little Bow River below Twin Valley Reservoir	Streamflow
RCLEARLK	Clear Lake near Stavely	Level
RLBOWCAR	Little Bow River at Carmangay	Streamflow
RLBOWTRA	Little Bow River above Traverse Reservoir	Streamflow

NOTE: DO – Dissolved Oxygen
TW – Water Temperature

Appendix A

A. GENERAL DEFINITIONS

1. Datasonde

Monitoring instrument used to measures hourly dissolved oxygen and temperature in the River

B. DEFINITION OF FLOWS

1. Measured Flows

Flow obtained by physical measurement of a watercourse taken by personnel working in the field. These are the best available instantaneous values. However, stream flow measurement is subject to uncertainty, particularly in winter conditions.

2. Computed Flows

Mean daily flows computed using mean water level data (obtained from telemetry devices) and flow measurement data. Air temperatures and other factors may be used to adjust for varying conditions. Daily flows are computed and distributed to all interested parties by Alberta Environment's Water Sciences group.

3. Official Flows

Mean daily flows published in the following year by Water Survey of Canada. Flows are computed based upon the best available information compiled throughout the year and include measurements made by Alberta Environment.

4. Operating Flows

Real-time instantaneous flows based upon electronic measuring devices, stage-discharge tables, the most recent measured flow, and at times operator judgement. The accuracy of the operating flows cannot be more accurate than the most recent measured flow.

5. Natural Flow

"Is quantity of water which would naturally flow in any water course if the flows had not been affected by any human interference or intervention." For the purposes of this plan, the natural flow in the Highwood River is the sum of the flow in the Highwood River below High River plus the flows

diverted from the Highwood River by the Little Bow Canal and the Women's Coulee diversions

6. Instream Flow Objective

Flows that are to be maintained in a stream as a result of dam operation or by restrictions on licences to provide some level of protection of the aquatic environment

Appendix B
Alert Condition Procedure

The stress conditions for the Highwood River are defined in the Highwood Diversion Plan. The Highwood River is considered to be approaching stress when:

i. Natural river flows are approaching 4.2 m^3/s (150 cfs)
ii. Water temperature is between 22.5°C & 24°C
iii. Dissolved oxygen is between 5 mg/L and 5.5 mg/L)

Should any of these conditions be met on the Highwood River, in order to prevent oxygen or temperature stress to the fish population as a result of irrigation diversions, an **Alert Condition** will be declared and the following procedure for dissemination information will be implemented.

1. The Bow Operations Technologist will monitor dissolved oxygen (DO) and Highwood River water temperature (Tw).

   A request may be made to Alberta Environment's Monitoring group to verify datasonde temperature readings at the Aldersyde gauging station using certified thermometers. For any assistance during weekends and holidays refer to the standby schedule attached.

2. When river flow conditions, during a period of successive warm days, indicate a potential for the Highwood River to become stressed, (using recorded data and "Environment's water temperature projection formula") the Bow Operations Manager will advise the following or their alternate of an the **Alert Condition**.

Southern Operations Manager	Calgary	Southern Operations, Water Management Operation, Regional Services, Alberta Environment
District Approvals Manager	Lethbridge	Southern Region, Regional Services, Alberta Environment
District Approvals Manager	Calgary	Southern Region, Regional Services, Alberta Environment
Fisheries Biologist	Calgary	Fisheries Management, Sustainable Resources
Limnologist	Calgary	Southern Region, Regional Services, Alberta Environment
Communications Personnel	Edmonton	Communication Division,

(The contact numbers for these individuals are located in Appendix C)

3. The District Approvals Managers will advise the irrigators about the Alert Condition.

4. The Bow and Southern Operations Managers will discuss what actions will be taken to minimize the effect of diversions to the Highwood River during the stress condition.

5. The Bow Operations Manager will advise the Bow Operations Technologist and District Approvals Managers of any proposed operating action.

6. The Bow Operations Technologist will undertake the appropriate operations and confirm with the Bow Operations Manager upon implementation.

7. As soon as possible, the District Approvals Managers will advise the irrigators of any proposed diversion amendments or of any license extension suspensions

8. Any fish kill reports should be directed to the District Fish and Wildlife Officer. This will be further referred to the Fisheries Biologist, if necessary. If the nature of the report relates to water management, the diversion operating personnel will be informed accordingly.

9. All questions from the media should be referred to Communications Personnel initially. The Communications Branch may request further information from any of the staff above or request a certain individual to address some technical questions.

Appendix C
Contact Numbers

NOTE:
The Information In This Appendix Contains Personal Information And Subject To FOIP. This table has been altered to protect the personal information of the individuals listed.

POSITON	NAME	ALTERNATE FOR	BUSINESS NUMBER	HOME NUMBER	CELLULAR / MOBILE
Director, WMO	Denis Magowan		381-5966		332-1437
Southern Operations Manager, WMO	Saba Gnanakumar		297-5938		542-6023
Bow Operation Manager	Brian Mallett		297-7093		807-6080
Approvals Manager, Lethbridge	Dave McGee		381-5995		331-5571
Approvals Manager, Calgary	Dave Ardell		297-5892		660-9130
Bow Operation Technologist	Satvinder Mangat		297-5936		512-0190
Limnologist	Al Sosiak		297-5921		
Fisheries Biologist	Jim Stelfox		851-2205		997-1676
Communications Personnel	Erin Carrier		427-2003		Cell: 780- 913-6614 Pager: 780-671-0549
Important Contacts					
Director, Southern Region	Jay, Litke		297-6070		
Calgary – West Area Team Leader	Italo Colistro		297-5935		651-0540
Highwood Diversion Contract Operator	Dave Gregory, Contract Operator		652-1443		333-5944
Monitoring	Hugh Howe		297-8108		369-5700
District Fish and Wildlife Officer	Roger Gluckie		652-8330	(For contract after office hours Call Control Centre 780-428-7120)	
Alternates					
Water Approvals Team Leader - Lethbridge	Kathleen Murphy	Dave McGee	382-4000		
Water Approvals Team Leader - Calgary	Kevin Wilkinson	Dave Ardell	297-5896		
Communications Personnel	Sherri-Dawn Annett	Erin Carrier	427-5521		913-6614
Highwood Diversion Contract Operator	Don Gregory Contract Operator	Dave Gregory	652-5099		803-5609
Fisheries Biologist	Jennifer Earls	Jim Stelfox	851-2211		